Installation and Maintenance Manual	IM-487-3
	Group: **Applied Systems**
	Part Number: IM-487
	Date: July 2002

RoofPak® Applied Rooftop Systems
Air Handler

RAH 047C - 077C
12,000 to 50,000 cfm (5663 to 23597 liters/second)

RDS 800C - 802C
4,000 to 20,000 cfm (1888 to 9439 liters/second)

ISO 9002 CERTIFIED

McQuay Air Conditioning

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Introduction

This manual provides general information about the "C" vintage McQuay RoofPak® applied rooftop unit, models RAH, and RDT. In addition to an overall description of the unit, it includes mechanical and electrical installation procedures, commissioning procedures, sequence of operation information, and maintenance instructions. For further information on the optional forced draft gas-fired furnace, refer to Bulletin No. IM 684 or IM 685.

The MicroTech II ™ applied rooftop unit controller is available on "C" vintage applied rooftop units. For a detailed description of the MicroTech II components, input/output configurations, field wiring options and requirements, and service procedures, *refer to IM696 for a description of operation and information on using and programming the MicroTech II unit controller, refer to the appropriate operation manual (See Table 1).*

For a description of operation and information on using the keypad to view data and set parameters, refer to the appropriate program-specific operation manual. *(See Table 1).*

Table 1: Program Specific Rooftop Unit Operation Literature

Rooftop Unit Control Configuration	Operation Manual Bulletin Number
VFD's	Vendor IM Manuals
Discharge Air Control (VAV or CAV)	OM 137
Space Comfort Control (CAV-Zone Temperature Control)	OM 138

Receiving Inspection

When the equipment is received, check all items against the bill of lading to be sure all crates and cartons have been received. **If the unit has become dirty during shipment (winter road chemicals are of particular concern), clean it when received.**

Inspect all units for damage when received. Report all shipping damage to the carrier and file a claim. In most cases, equipment is shipped F.O.B. factory and claims for freight damage should be filed by the receiver.

The unit nameplate should be checked before unloading the unit to make sure the voltage complies with the power supply available.

Hazard Identification Information

⚠ WARNING

Warnings are provided throughout this manual to indicate to installing contractors, operators, and service personnel potentially hazardous situations which, if not avoided, can result in severe personal injury or property damage.

⚠ CAUTION

Cautions are provided throughout this manual to indicate to installing contractors, operators, and service personnel potentially hazardous situations which, if not avoided, can result in personal injury or equipment damage.

Nomenclature

R AH — 047 C S E

RoofPak

Unit Size
- RDS 800 = 4000 - 16000 CFM
- RDS 802 = 8000 - 20000 CFM
- RAH 47 = 12000 - 30000 CFM
- RAH 77 = 23000 - 50000 CFM

Heat Medium
- A = Natural Gas
- E = Electric
- F = Fuel Oil
- S = Steam
- W = Hot Water
- Y = None

Cooling Coil Size
- S = Standard (Low Airflow)
- L = Large (High Airflow)
- Y = None or Contractor Coil

Design Vintage

Typical Component Locations

Figure 1 shows a typical Blow-Through unit with the locations of the major components. *Figure 2 on page 5* shows a typical Draw-Through unit with the locations of the major components. These figures are for reference only. See the certified submittals for actual specific dimensions.

Figure 1. Blow-Through Configuration (Unit Size 077C Shown)

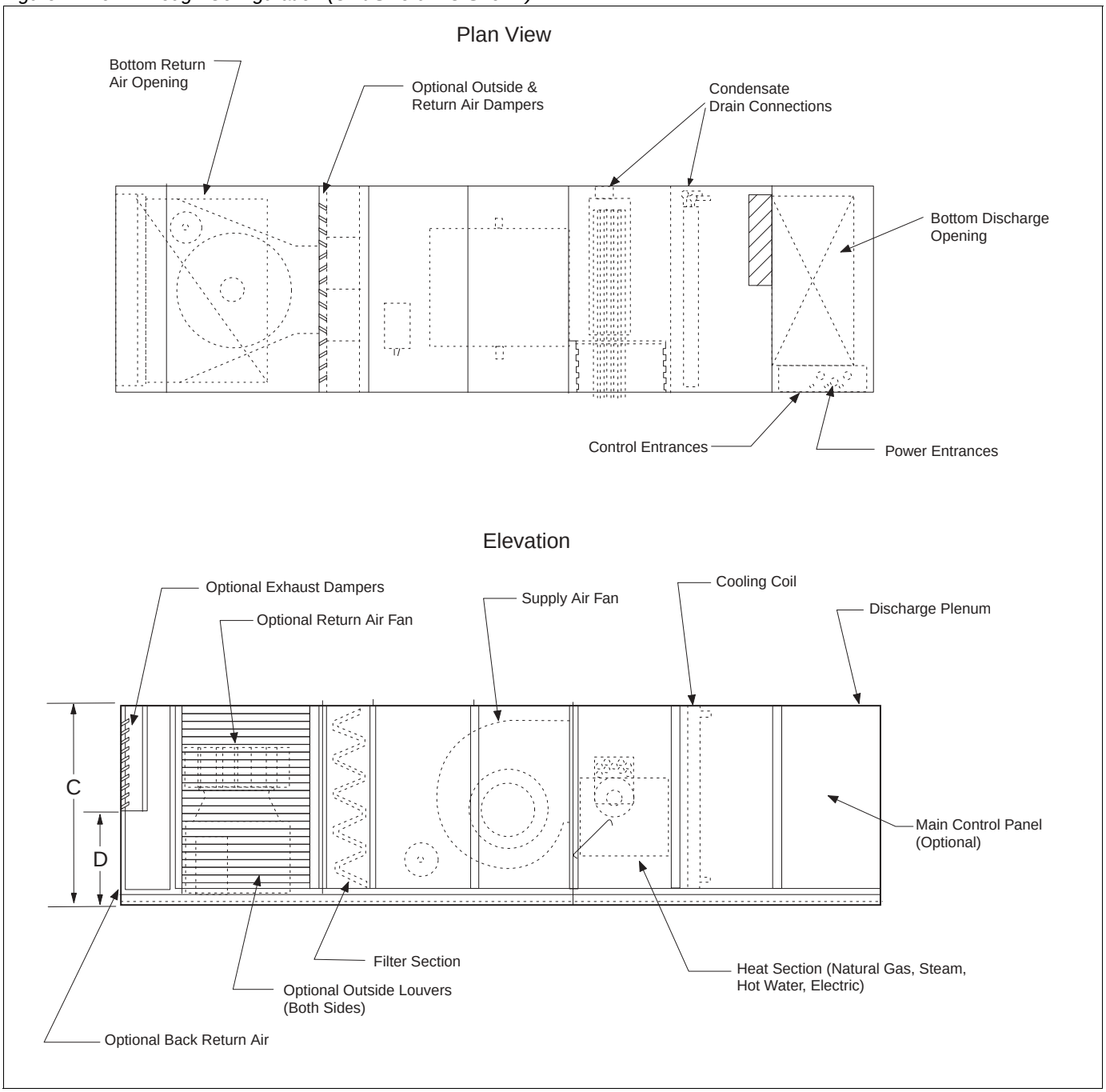


Figure 2. Draw-Through Configuration with SWSI Supply Fan (Unit Size 077C Shown)

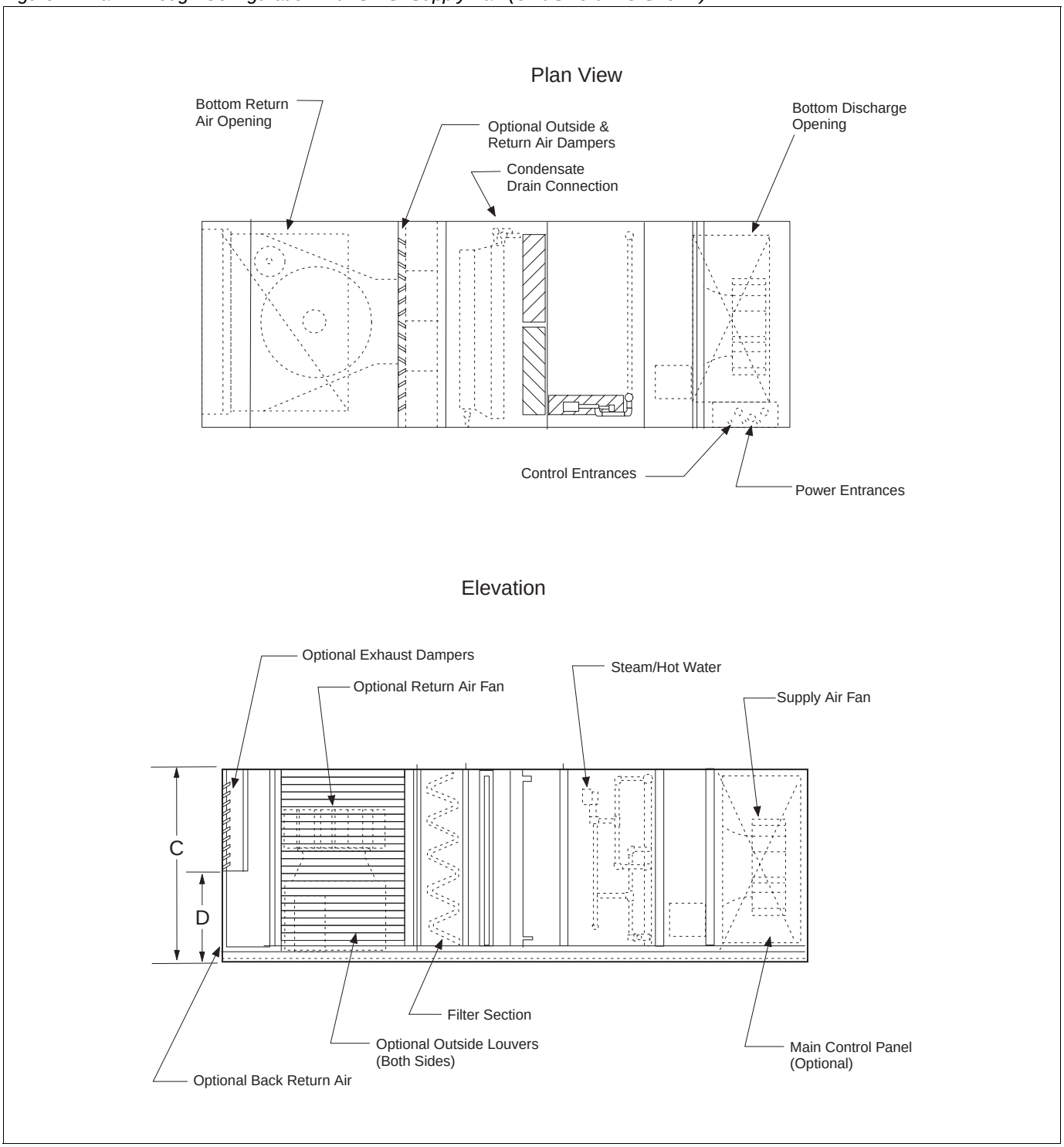
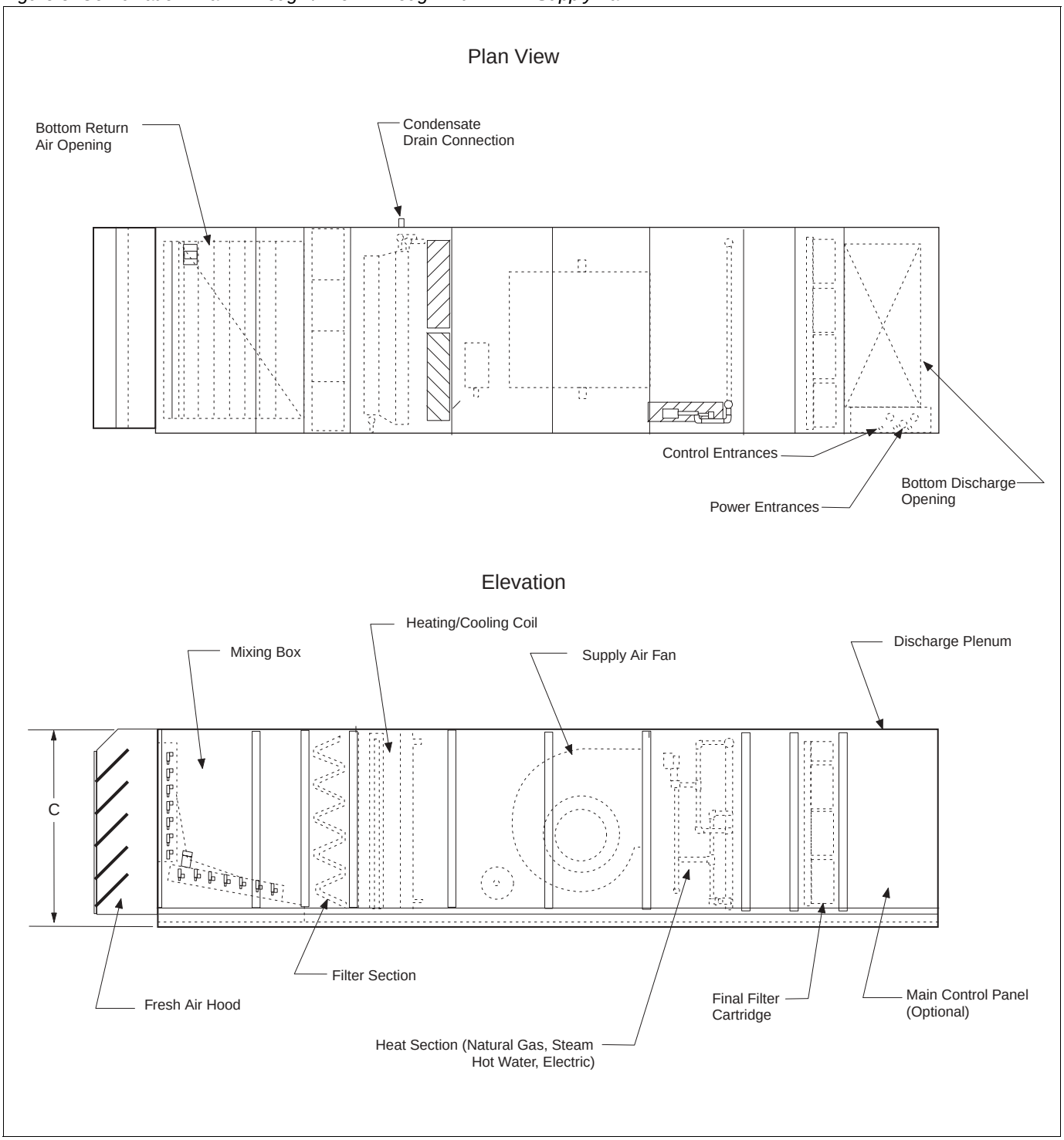


Figure 3. Combination Draw-Through / Blow-Through with DWDI Supply Fan



Typical Unit Sections

The individual sections that make up a rooftop can vary from unit to unit. All available sections are shown in *Figure 4* and *Figure 5*.

Figure 4. Typical Unit Sections (Draw-Through and Blow-Through with DWDI Supply Fan)

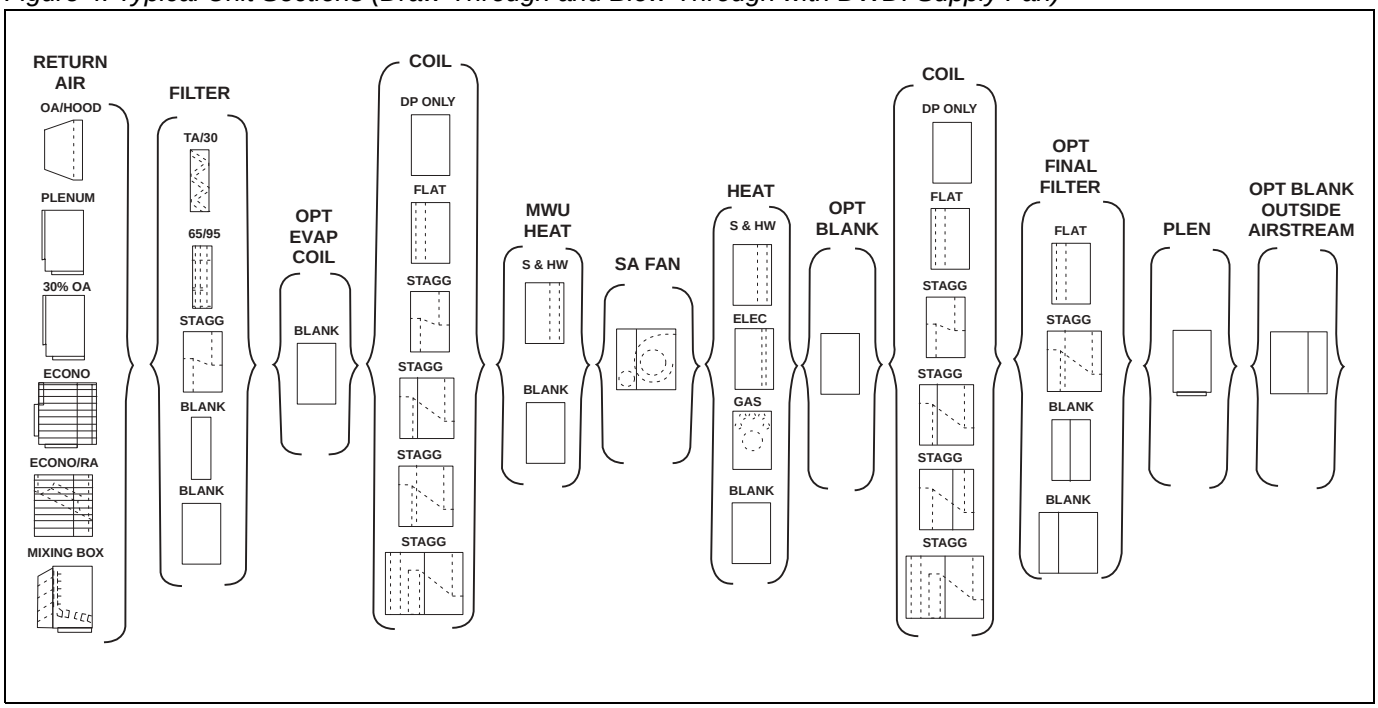
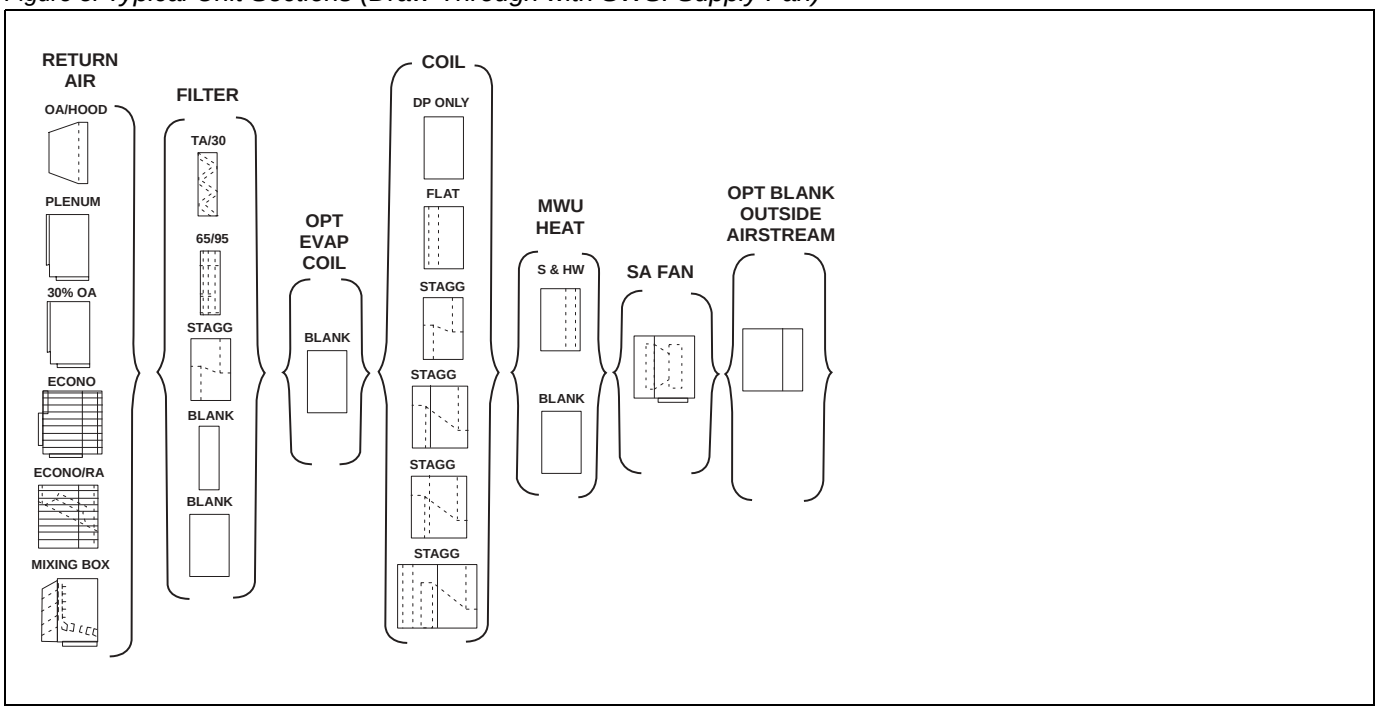


Figure 5. Typical Unit Sections (Draw-Through with SWSI Supply Fan)

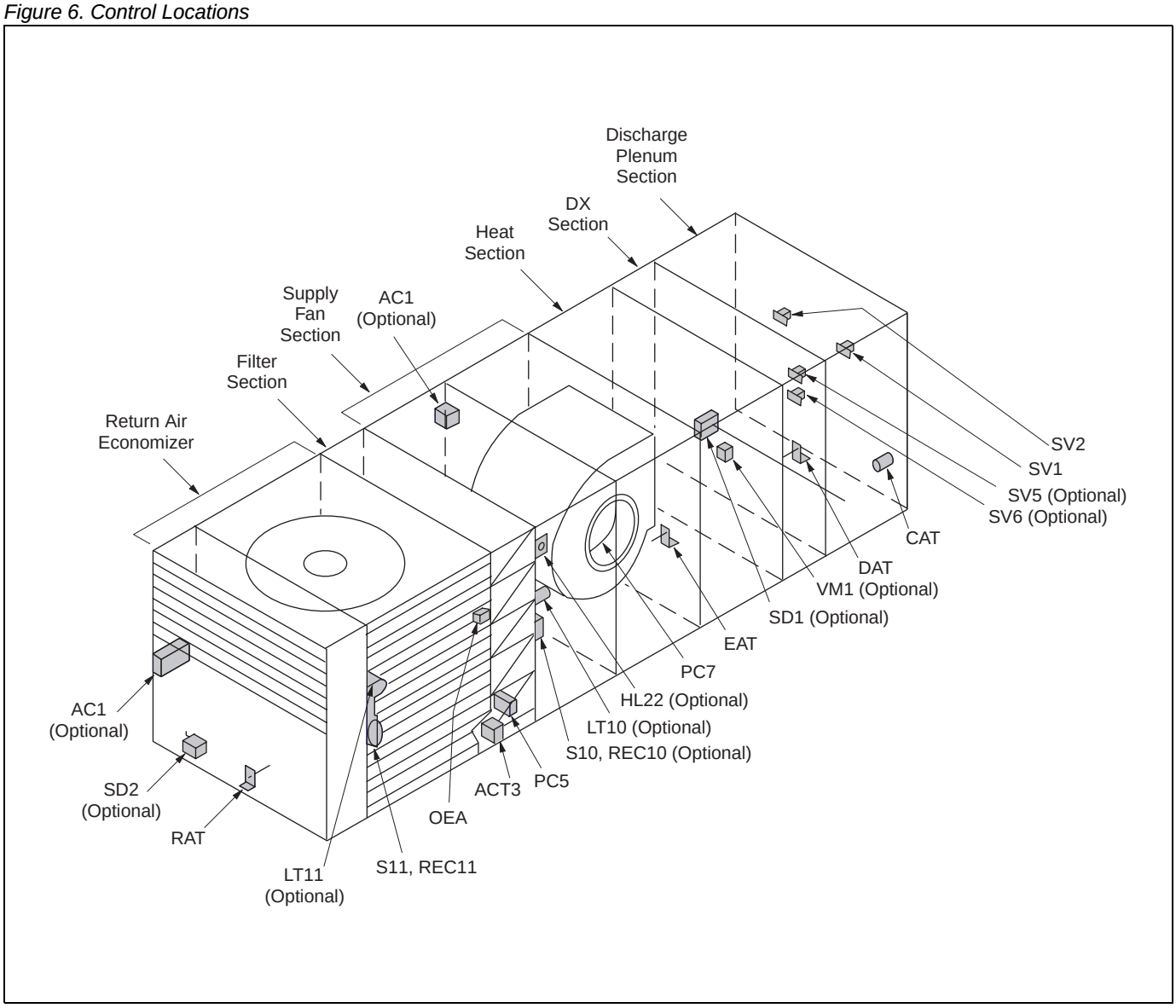


Note: Views shown for 047C family. Not to scale

Control Locations

All controls are optional. If controls are ordered, *Figure 6* shows the locations of various control components mounted throughout the unit. See *"Control Panel Locations" on page 9* for the locations of control components mounted in control panels. Additional information is included in *Table 2 on page 13* and the wiring diagram legend at the beginning of *"Wiring Diagrams" on page 48*. *Figure 6* shows the blow-through heat and blow-through coil sections. These sections are also available in the draw-through position. All controls mounted in the blow-through section would be located in the same position within the draw-through section.

Figure 6. Control Locations



Note: See the wiring diagrams legend at the beginning of *"Wiring Diagrams" on page 48* for designation /description.

Control Panel Locations

The unit control panels and their locations are shown in the following figures. These figures show a typical unit configuration. Specific unit configurations may differ slightly from these figures depending on the particular unit options.

Figure 7. Control Panel Locations

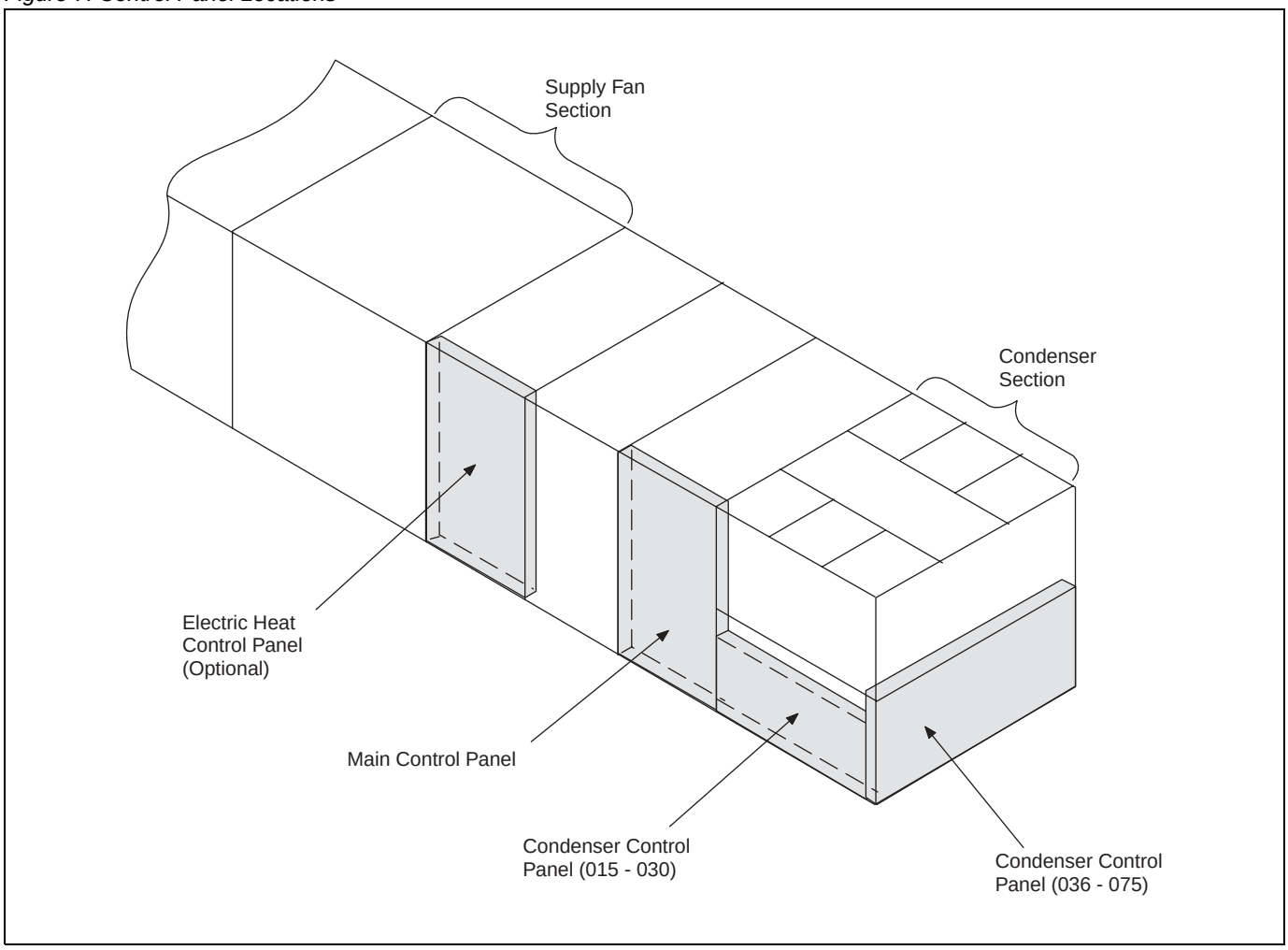
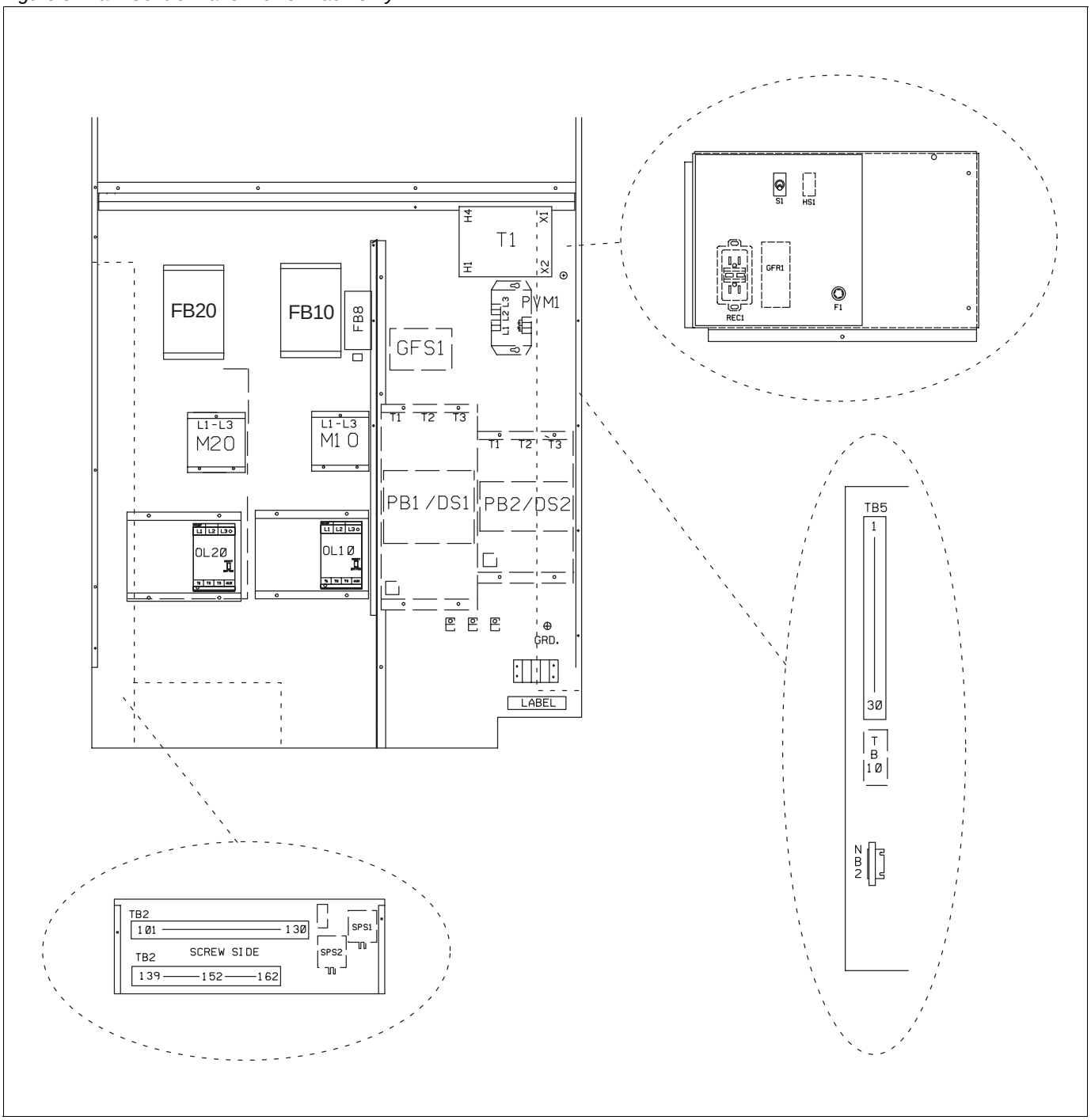
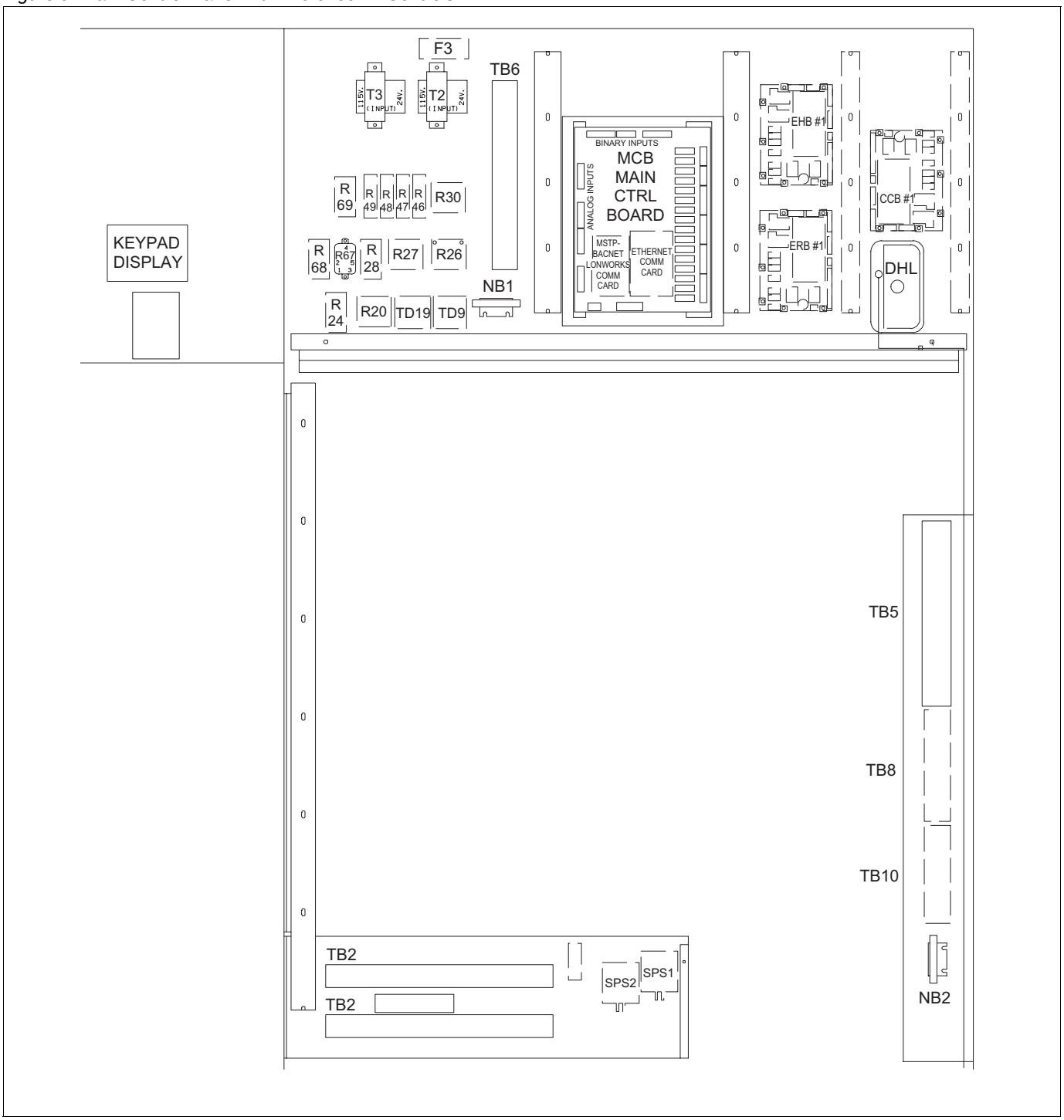

Supply Fan Section
Condenser Section
Electric Heat Control Panel (Optional)
Main Control Panel
Condenser Control Panel (015 - 030)
Condenser Control Panel (036 - 075)

Figure 8. Main Control Panel Power Pack Only



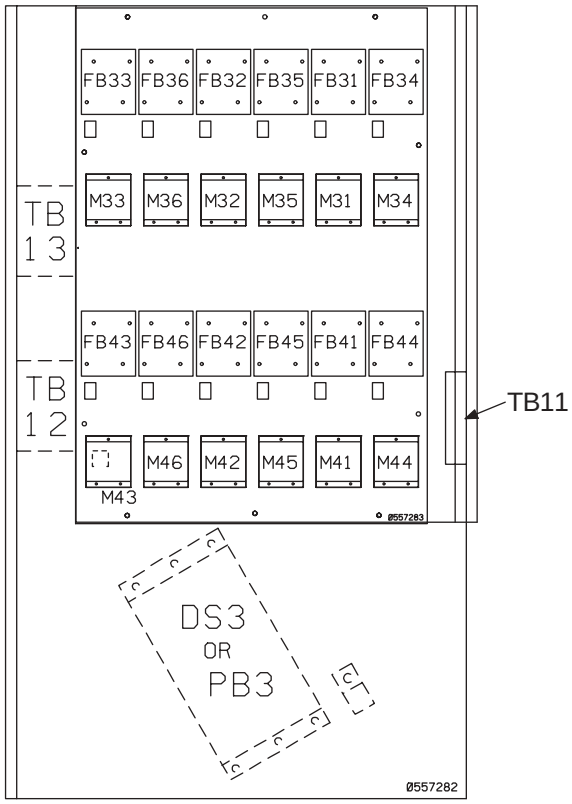
Note: See the wiring diagrams legend at the beginning of *"Wiring Diagrams" on page 48* for designation /description.

Figure 9. Main Control Panel with MicroTech II Controls



Note: See the wiring diagrams legend at the beginning of *"Wiring Diagrams" on page 48* for designation /description.

Figure 10. Electric Heat Control Panel



Note: See the wiring diagrams legend at the beginning of *"Wiring Diagrams" on page 48* for designation /description.

Controls, Settings, and Functions

Table 2: Controls, settings and functions

SYMBOL	DESCRIPTION	FUNCTION	RESET	LOCATION	SETTING	RANGE	DIFFERENTIAL	PART NO.
DAT	Discharge air temperature sensor	Senses discharge air temperature.	N/A	Discharge air section	N/A	3K ohms at 77°F (25°C)	N/A	060004705
DHL	Duct high limit switch	Prevents excessive VAV duct pressures; shuts off fan.	Auto	Main control panel	3.5” w.c (871.8 Pa)	0.05-5.0” w.c. (12.5-1245.4 Pa)	.05" w.c. (12.5 Pa), fixed	065493801
EFT	Entering fan air temperature sensor	Senses entering fan air temperature	N/A	Inlet of supply fan	N/A	3K ohms at 77°F (25°C)	N/A	060004705
FS1	Freezestat	Shuts off fans, opens heating valve and closes outdoor damper if low air temperature at coil is detected.	Auto	Heating section	38°F (3°C) or as required	35°F - 45°F (2°C - 7°C)	12°F (7°C), fixed	065830001
OAE	Enthalpy control (electromechanical)	Returns outside air dampers to minimum position when enthalpy is too high.	Auto	Economizer section	"B" or as required	A — D	Temperature: 3.5°F (2°C) Humidity: 5% fixed	030706702
	Enthalpy control (electronic)	Returns outside air dampers to minimum position when outside air enthalpy is higher than return air empalthy (use RAE)	Auto	Economizer section	Fully CW past "D" (when used with RAE)	A — D	N/A	049262201
OAT	Outside air temperature sensor	Senses outside air temperature.	N/A		N/A	3K ohms at 77°F (25°C)	N/A	060004705
PC5	Dirty Filter switch	Senses filter pressure drop.	Auto	First Filter section	As required	.05-5” w.c. (12.5-1245.4 Pa)	.05” w.c. (12.5 Pa)	065493801
PC6	Dirty Filter switch	Senses filter pressure drop.	Auto	Final Filter section	As required	.05-5” w.c. (12.5-1245.4 Pa)	.05” w.c. (12.5 Pa)	065493801
PC7	Air flow proving switch	Senses supply fan pressure to prove airflow.	Auto	Supply fan section	.10" w.c. (25 Pa)	.05-5” w.c. (12.5-1245.4 Pa)	.05” w.c. (12.5 Pa), fixed	060015801
RAE	Return air enthalpy sensor	Used to compare return air enthalpy to outside air enthalpy (used with OAE).	N/A	Economizer section	N/A	N/A	N/A	049262202
RAT	Return air temperature sensor	Senses return air temperature.	N/A	Return air section	N/A	3K ohms at 77°F (25°C)	N/A	060004705
SD1	Smoke detector, supply air	Initiates unit shutdown if smoke is detected.	Manual	Discharge air section	N/A	N/A	N/A	04925001
SD2	Smoke detector, return air	Initiates unit shutdown if smoke is detected.	Manual	Return air section	N/A	N/A	N/A	04925001
SPS1	Static Pressure Sensor Duct # 1	Converts static pressure signals to voltage signals.	N/A	Main control box	N/A	0—5” w.c. (0—1245.4 Pa) 1—6 VDC out	N/A	049545005
SPS2	Static Pressure Sensor Duct # 2	Converts static pressure signals to voltage signals and sends them to MicroTech II controller.	N/A	Main control box	N/A	0—5” w.c. (0—1245.4 Pa) 1—6 VDC out	N/A	049545005
	Static Pressure Sensor: Building (Space) Pressure	Converts static pressure signals to voltage signals.	N/A	Main control box	N/A	-025—0.25” w.c. (-62.3—62.3 Pa) 1—5 VDC out	N/A	049545006
S1	System Switch	Shuts off entire control circuit (except crankcase heaters)	N/A	Main control box	N/A	N/A	N/A	001355000
S7	ON-OFF-AUTO switch	Used to manually switch unit.	N/A	Main control box	N/A	N/A	N/A	

Mechanical Installation

The installation of this equipment shall be in accordance with the regulations of authorities having jurisdiction and all applicable codes. It is the responsibility of the installer to determine and follow the applicable codes.

⚠ WARNING

Sharp edges and coil surfaces can cause personal injury. Avoid contact with them.

Installation and maintenance must be performed only by trained and experienced personnel familiar with local codes and regulations.

⚠ WARNING

Sharp edges on sheet metal, screws and clips can cause personal injury.

This equipment must be installed and operated only by experienced trained personnel.

Unit Clearances

Service Clearance

Allow service clearance approximately as indicated in *Figure 11*. Also, provide a roof walkway rooftop unit and along at least the two sides of the unit that provide access to most controls and serviceable components.

Figure 11. Service Clearances - Unit with Housed DWDI Supply Fan

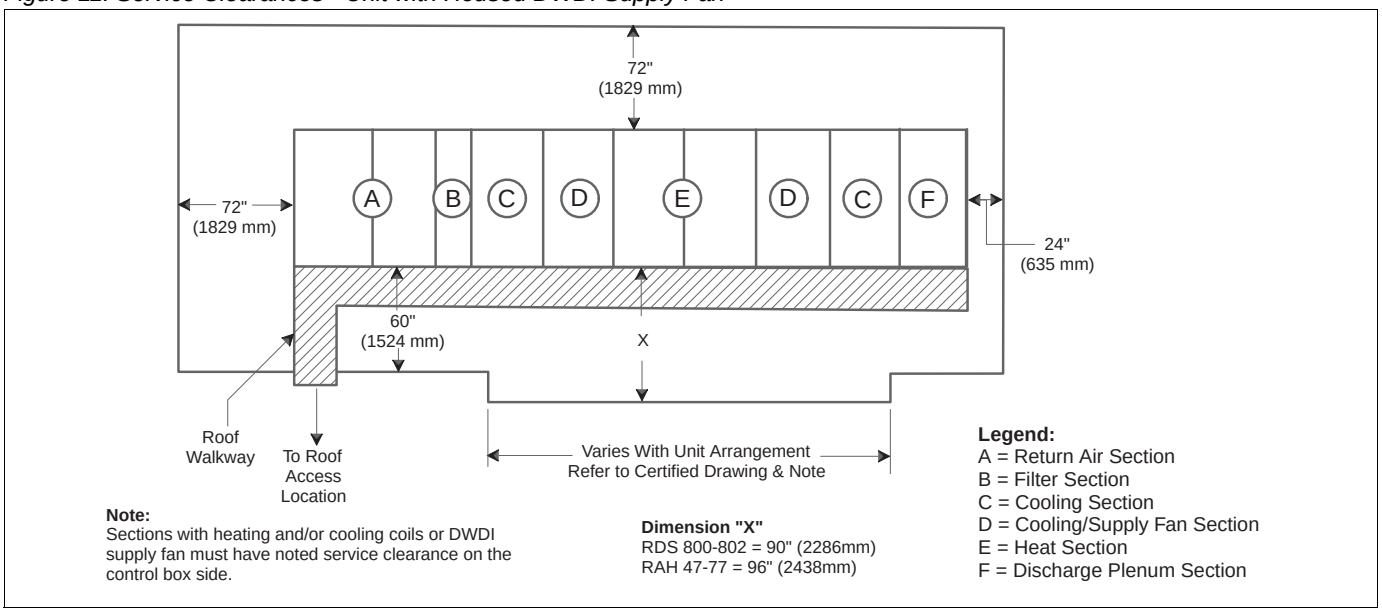
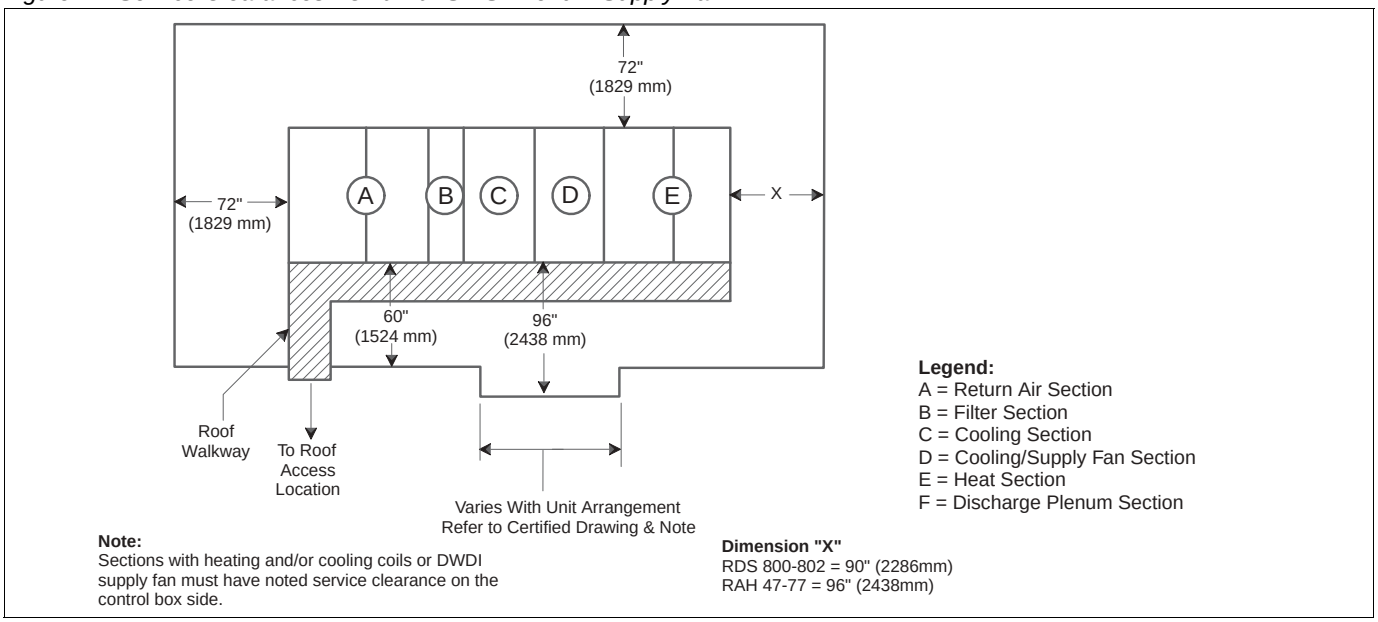


Figure 12. Service Clearances - Unit with SWSI Plenum Supply Fan



Ventilation Clearance

Following are minimum ventilation clearance recommendations. The system designer must consider each application and provide adequate ventilation. If this is not done, the unit will not perform properly.

Unit(s) surrounded by a screen or a fence:

1. The bottom of the screen or fence should be at least 1 ft. (305 mm) above the roof surface.
2. The distance between the unit and a screen or fence should be as described in *"Service Clearance" on page 14*. *See also Figure 11 on page 14*.
3. The distance between any two units within a screen or fence should be at least 120" (3048 mm).

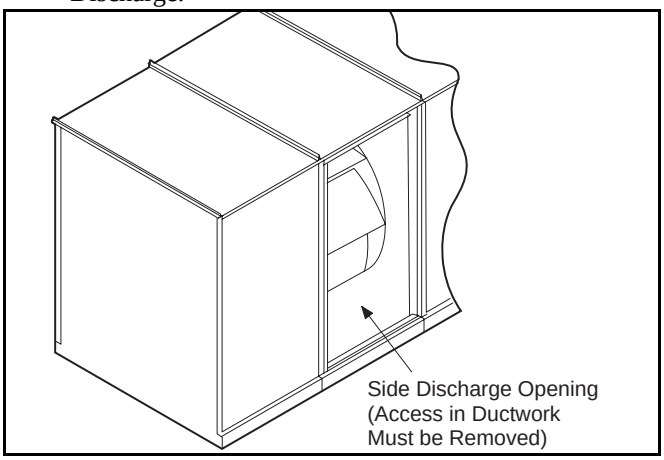
Unit(s) surrounded by solid walls:

1. If there are walls on one or two adjacent sides of the unit, the walls may be any height. If there are walls on more than two adjacent sides of the unit, the walls should not be higher than the unit.
2. The distance between the unit and the wall should be at least 96" (2438 mm) on all sides of the unit.
3. The distance between any two units within the walls should be at least 120" (3048 mm). Do not locate outside air intakes near exhaust vents or other sources of contaminated air.

If the unit is installed where windy conditions are common, wind screens should be installed around the unit, maintaining the clearances specified *(see Figure 13)*. This is particularly important to prevent blowing snow from entering outside air intakes, and to maintain adequate head pressure control when mechanical cooling is required at low outdoor air temperatures.

Overhead clearance

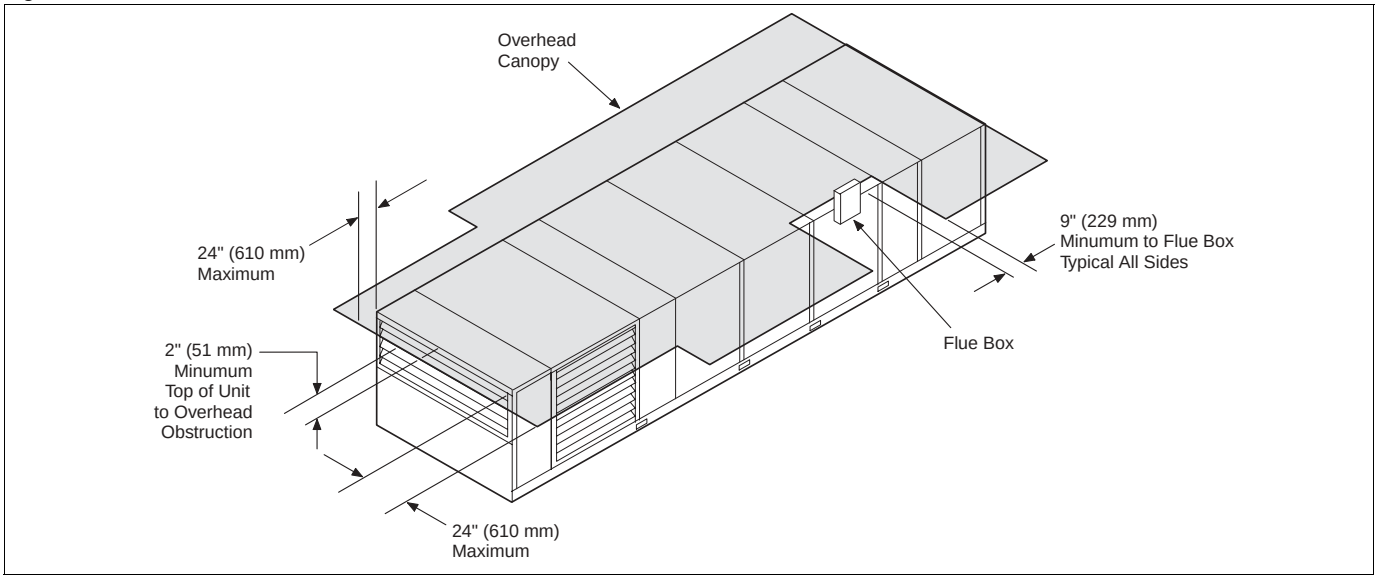
1. Unit(s) surrounded by screens or solid walls must have no overhead obstructions over any part of the unit.
2. The following restrictions must be observed for overhead obstructions above the air handler section *(see Figure 13):*
   a. There must be no overhead obstructions above the furnace flue, or within 9" (229 mm) of the flue box.
   b. Overhead obstructions must be no less than 2" (51 mm) above the top of the unit.
   c. There must be no overhead obstructions in the areas above the outside air and exhaust dampers that are farther than 24" (610 mm) from the side of the unit.Side Discharge.



NOTICE

On units with side discharge, access to plenum mounted components becomes difficult once ductwork is installed. Installer must provide access in the ductwork for plenum mounted controls.

Figure 13. Overhead Clearance



Roof Curb Assembly and Installation

Locate the roof curb and unit where the roof can support the weight. Support the unit to prevent bending or twisting of the machine. If the building allows sound and vibration into the occupied space, **locate the unit over a non-critical area. It is the responsibility of the system designer to make adequate provisions for noise and vibration in the occupied space.** Install the curb and unit level to allow the condensate drain to flow properly with absolutely no pitch away from the drain. Integral supply and return air duct flanges are provided with the RAH roof curb, allowing connection of ductwork to the curb before the unit is set. The gasketed top surface of the duct flanges seals against the unit when it is set on the curb. These flanges must not support the total weight of the ductwork. *Refer to "Installing Ductwork" on page 22* for details on duct connections. Assembly of a typical RAH roof curb is shown in. Parts A through H are common to all units having bottom return openings. Depending on the unit length, Parts L and M may be included with the roof curb kit to create the correct overall curb length.

Figure 14. RAH Roof Curb Assembly Instructions

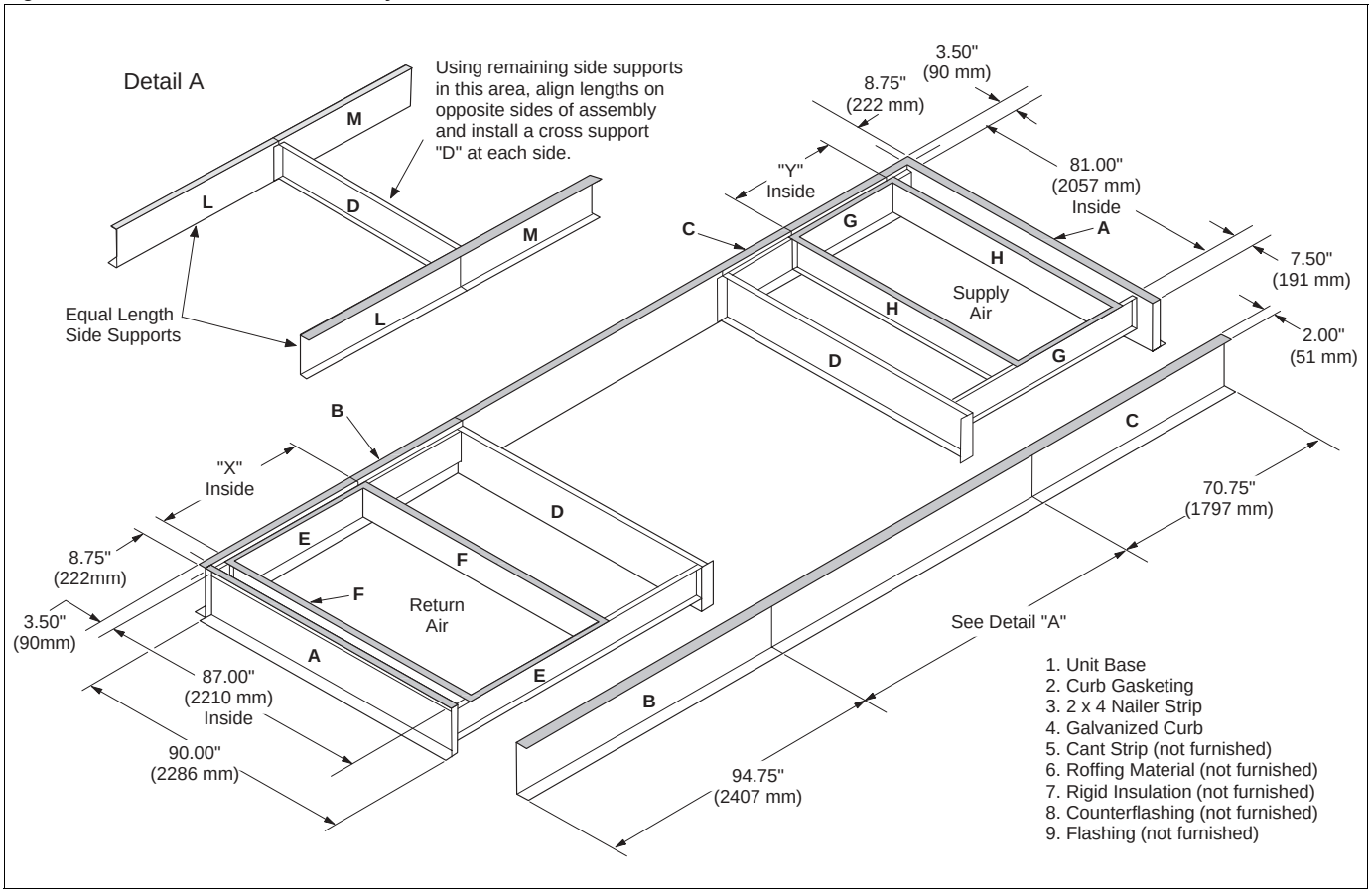
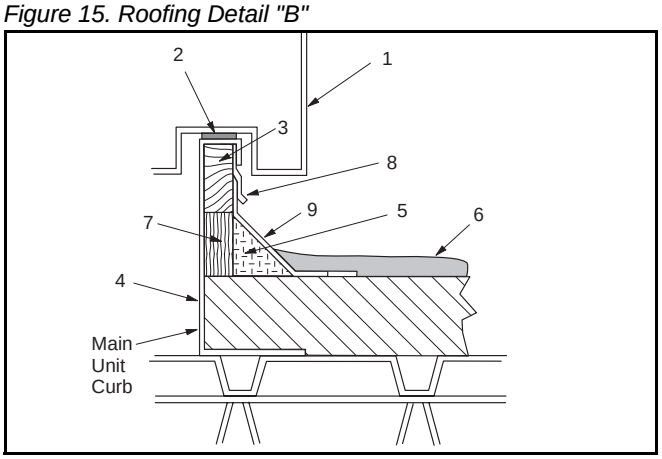


Figure 15. Roofing Detail "B"

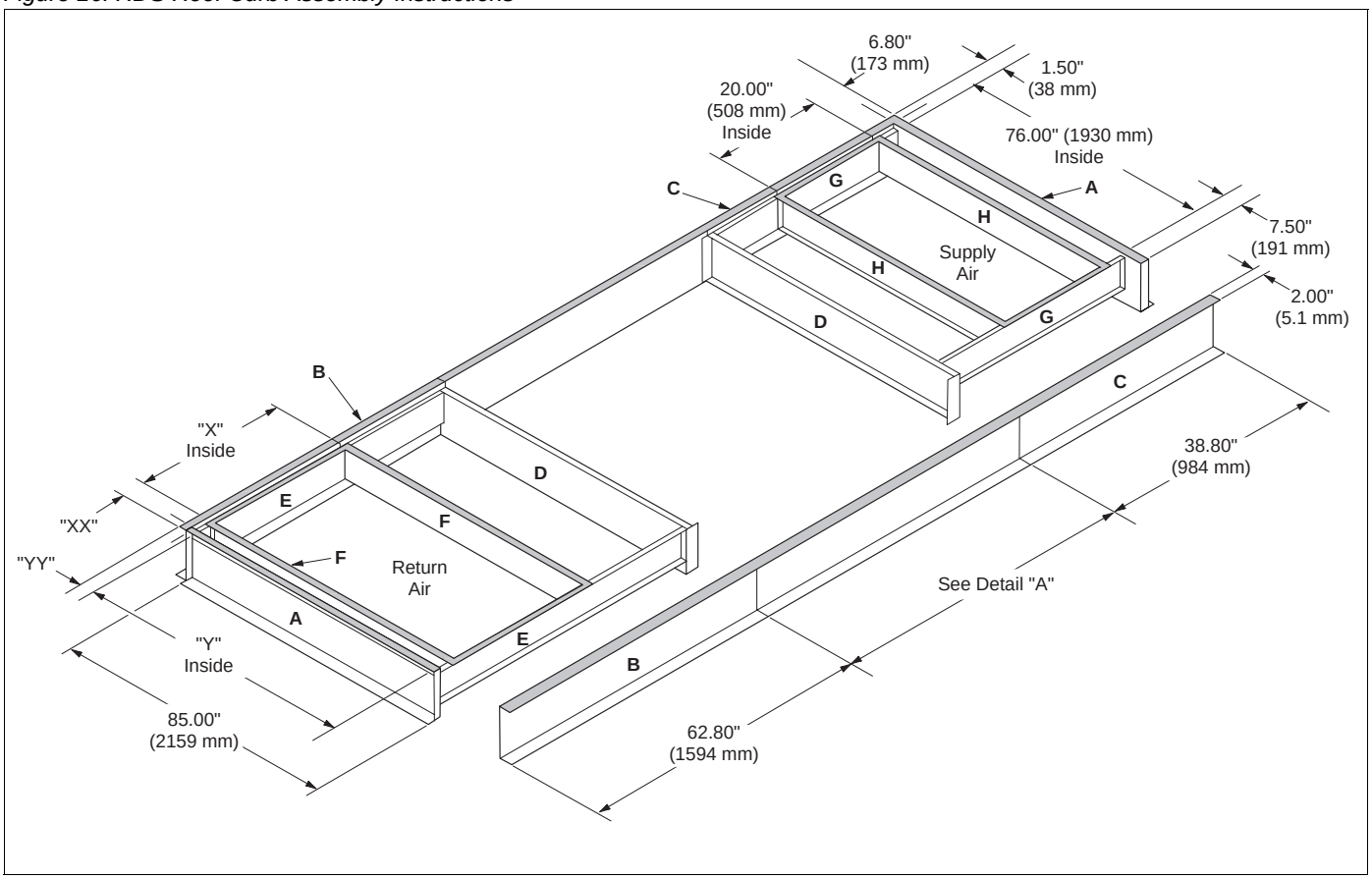


RAH Unit	Dimensions In. (mm)	
	"X"	"Y"
047C	38 (965)	28 (711)
077C with Flat Cooling Coil and /or 44" SWSI Plenum Supply Fan	62 (1575)	38 (965)
077C with Staggered or No Cooling Coil, and /or 49" SWSI Plenum Supply Fan	62 (1575)	46 (1168)

Assembly Instructions:

1. Set curbing parts A thru H per dimensions shown over roof opening or on a level surface. Note location of return and supply air openings.
2. If applicable, set other curbing parts (D, L, M, etc.) in place making sure that the orientation agrees with the assembly instructions. Check alignment of all mating bolt holes. See Detail "A".
3. Bolt curbing parts together using fasteners provided. Tighten all bolts finger tight.
4. Square entire curbing assembly and securely tighten all bolts.
5. Position curb assembly over roof openings. Curb must be level from side to side and over its length. Check that top surface of the curb is flat with no bowing or sagging.
6. Weld curbing in place. Caulk all seams watertight. Remove backing from 0.25 thick x 1.50 wide gasketing and apply to surfaces shown by crosshatching.
7. Flash curbing into roof as shown in Detail "B".
8. Parts E and F are not required on units with no return shaft within the curb perimeter.
9. Parts G and H are not required on units with no supply shaft within curb perimeter.

Figure 16. RDS Roof Curb Assembly Instructions



RETURN FAN	"X"		"Y"		"XX"		"YY"	
	IN.	MM	IN.	MM	IN.	MM	IN.	MM
NONE	24.0	610	82.0	2083	6.8	173	1.5	38
(2) 15" FC	24.0	610	82.0	2083	6.8	173	1.5	38
30" AF	30.0	762	76.0	1930	6.8	173	4.5	114
40" AF	36.0	914	78.0	1981	14.8	376	3.5	89

Post and Rail Mounting

When mounting by post and rail, the structural support should run the full length of the unit. Locate the structural member at the base of the unit as shown in *Figure 17*.

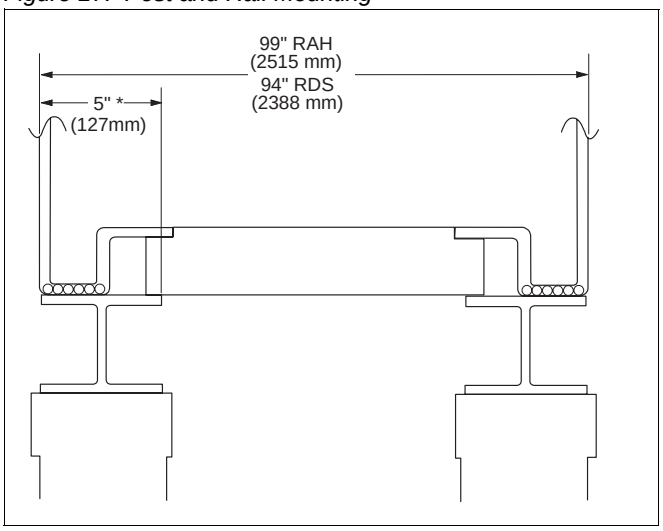
⚠ CAUTION

The unit must be level side to side and over the entire length.

Equipment damage can result if the unit is not level.

If resilient material is placed between the unit and the rail, insert a heavy steel plate between the unit and the resilient material to distribute the load. Seal cabinet penetrations (electrical, piping, etc.) properly to protect against moisture and weather.

Figure 17. Post and Rail Mounting



Maximum recommended width for structural member is 5" (127 mm) to allow for adequate space for duct connections and electrical entry.

Rigging and Handling

Lifting brackets with 2" (51 mm) diameter holes are provided on the sides of the unit.

Use spreader bars, 101" to 105" (2565 to 2667 mm) wide to prevent damage to the unit cabinet. Avoid twisting or uneven lifting of the unit. The cable length from the bracket to the hook should always be longer than the distance between the outer lifting points.

If the unit must be stored at the construction site for an intermediate period, take these additional precautions:

1. Support the unit well along the length of the base rail.
2. Level the unit (no twists or uneven ground surface).
3. Provide proper drainage around the unit to prevent flooding of the equipment.
4. Provide adequate protection from vandalism, mechanical contact, etc.
5. Securely close the doors.
6. Cover the supply and return air openings on units without isolation dampers.
7. Fully close the factory installed isolation dampers to prevent the entry of animals and debris through the supply and return air openings.

Note: Refer to *"Unit Storage" on page 84*.

Figure 18 shows an example of the rigging instruction label shipped with each unit.

⚠ WARNING

Use all lifting points.

Severe personal injury and property damage can result from improper lifting adjustment.

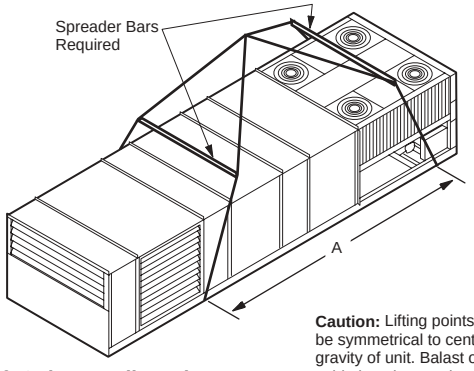
Figure 18. Rigging and Handling Instruction Label

Rigging and Handling Instructions

Unit has either four or six lifting points (four-point shown below).

Caution: All lifting points must be used.

Note: Rigging cables must be at least as long as distance "A".



Caution: Lifting points may not be symmetrical to center of gravity of unit. Balast or unequal cable lengths may be required

Lift Only As Indicated

Lifting Points

Use *Table 3 & Table 4* and *Figure 19* to determine lifting cable lengths and if four or six-pint lifting is required.

Refer to *Figure 19* and note that dimension A is the distance between the outer lifting points. The four outer rigging cables must be equal to or longer than dimension A. Dimension B shows the minimum distance between the outer and the inner lifting points for six-point lifting. This can be used to roughly determine the required length of the middle cables for six-point lifting. Dimension A can be determined by subtracting dimensions X and Y from dimension Z.
(i.e., A = Z - X).

Where:

Z =Total unit length in inches
(refer to certified drawings for this dimension).

X =Outdoor/return air section length
(*refer to Table 3 for this dimension).*

If A ≤ 288" (7315 mm), 4-point lifting is sufficient.

If A > 288" (7315 mm), 6-point lifting is required.

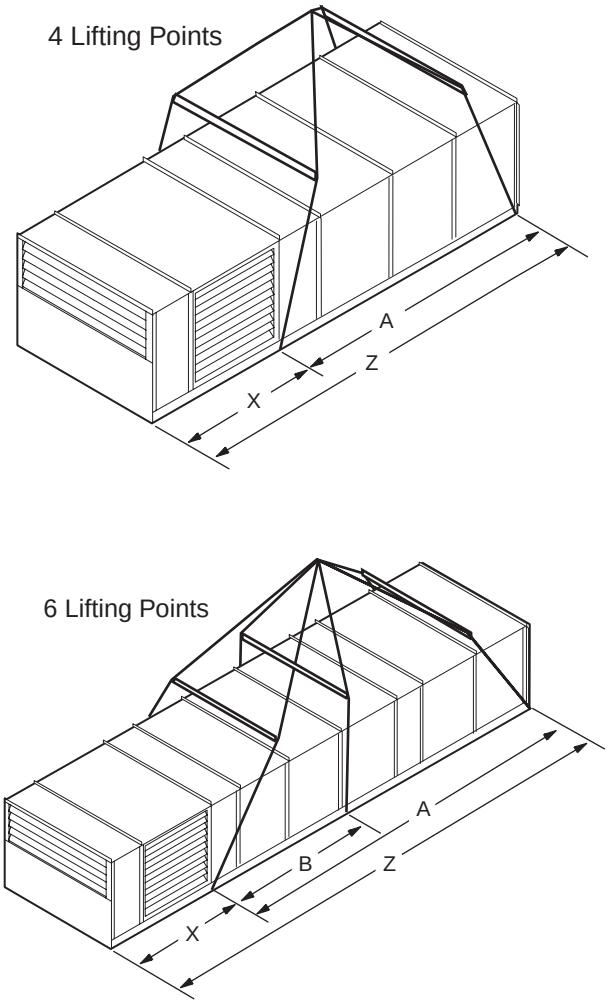
Table 3: RAH "X" Dimension (see Figure 19)

Type of Economizer Section	047C	077C
100% OA	0	0
Plenum	48” (1219 mm)	72” (1829 mm)
0- 30% OA	48” (1219 mm)	72” (1829 mm)
0 - 100% Economizer	72” (1829 mm)	96” (2438 mm)
0 - 100% Economizer With Return Fan	72” (1829 mm)	96” (2438 mm)

Table 4: RDS "X" Dimension (see Figure 19)

Outdoor/Return Air Section	800C	802C
100% OA	0	0
Plenum	40” (1016 mm)	52" (1321 mm)
0- 30% OA	40” (1016 mm)	52" (1321 mm)
0 - 100% Economizer	40” (1016 mm)	52" (1321 mm)
0 - 100% Economizer With 15" Return Fan	62" (1575 mm)	—
0 - 100% Economizer With 30" Return Fan	52" (1321 mm)	52" (1321 mm)
0 - 100% Economizer With 40" Return Fan	—	80" (2032 mm)

Figure 19. Unit Type RAH Lifting Points



RDS 800: B Min. = 62" (1515 mm)
RDS 802: B Min. = 84" (2134 mm)
RAH 47: B Min. = 96" (2438 mm)
RAH 77: B Min. = 120" (3048 mm)

Split Units

Although units typically ship from the factory as complete units, they can be factory split at the supply fan bulkhead and connected later on the roof. This configuration is ordered if the shipping length or a weight limitation prevents ordering a packaged unit.

A single nameplate is attached to the air handler section and power is supplied to both sections through the optional main control box as in a packaged unit.

Reassembly of Split Units

Field reassembly of a unit shipped split at the fan takes place in two places:

1. Setting the sections and mechanically recoupling the cabinet.
2. Reconnecting power and control wiring if optional power pack and/or controls are used.

Setting the Sections and Cabinet Reassembly

Steps 1 to 5 describe what is required to set the unit and reassemble the cabinet. Note also the following items:

- Top cap and plywood covers must be removed before the sections are set together, but the steel retainer clips must be left in place to secure the bulkhead. *Refer to Step #1* and *Figure 20*.
- Both sections must be lowered into place carefully to make sure that the roof curb engages the recesses in the unit base.
- All seams at the split must be caulked watertight after recoupling the sections, as shown in *Step #3 and Figure 21 on page 21*.

Reconnecting Power and Control Wiring (Units With Optional Factory Wiring)

The discharge sections contain power and control harnesses which have their excess length in the blank or heat section that is normally immediately downstream of the fan. Once the sections are physically reconnected, the ends of the power harness are fed back through the unit base into the junction box, per the unit's electrical schematics.

⚠ WARNING

Connect the power block correctly and maintain proper phasing.

Improper installation can cause severe equipment damage, personal injury or death.

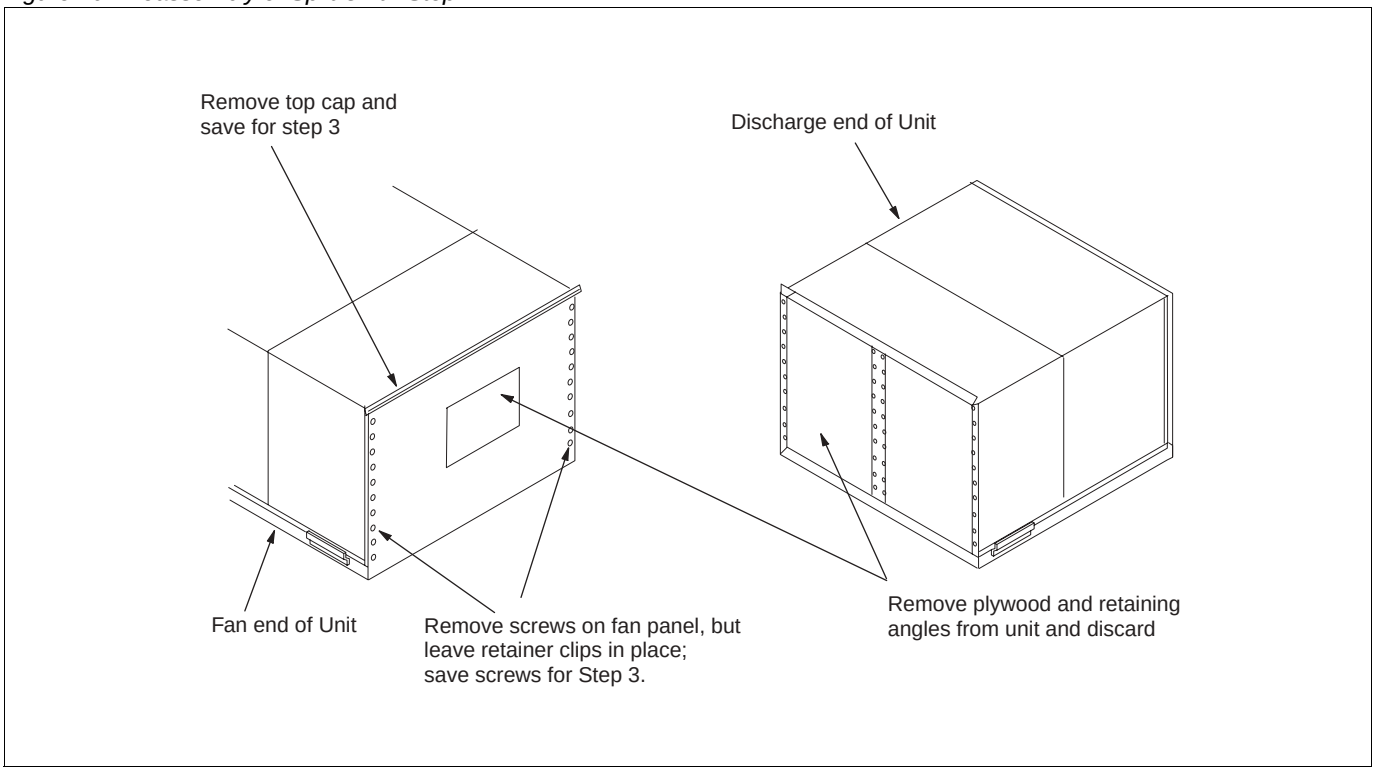
After the power wires are reconnected, the inner raceway cover in the blank or heat section must be reinstalled. Step 4 of *Figure 22 on page 21* shows a typical installation of a raceway cover.

Run control harnesses by removing the external raceway covers on either side of the unit. Excess harness may be removed from the external raceway on the discharge side of the split, routed along the raceway through the brushed hole in the fan section, and into the junction box where control wiring terminal blocks are provided for reconnection. Make electrical connections using the unit's electrical schematics. Reinstall the external raceway covers after the control wires are routed.

Step 1.
Prepare units for reassembly as shown in *Figure 20*.

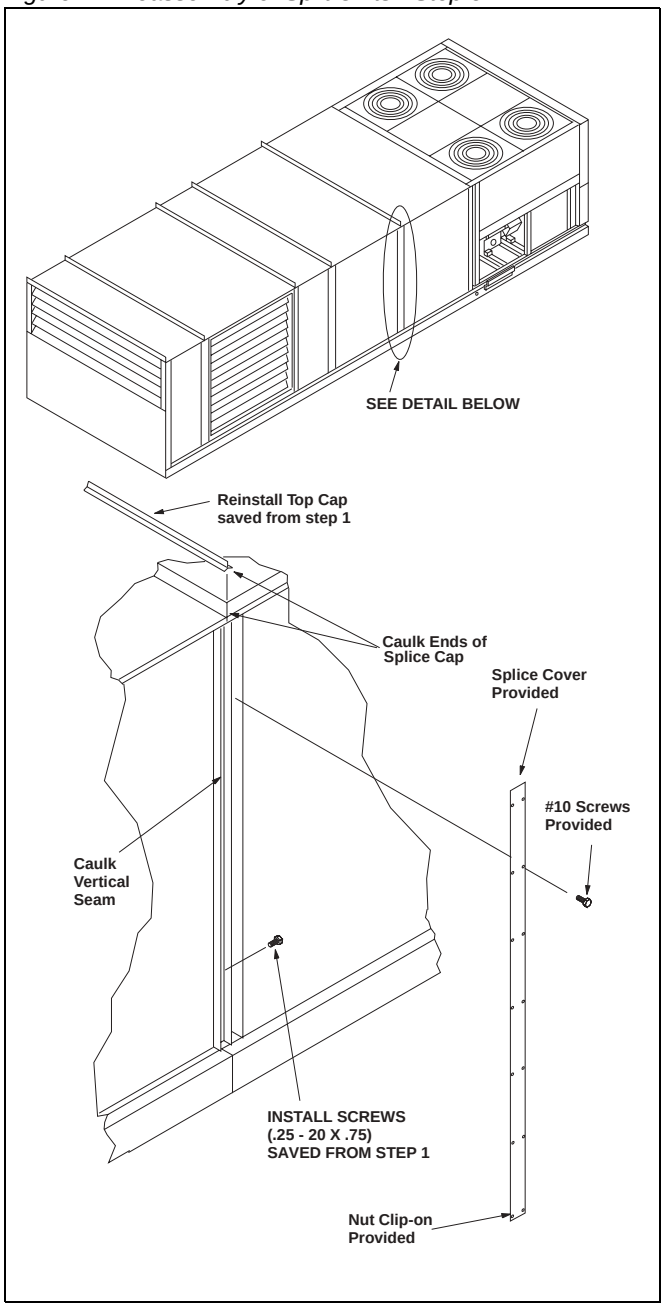
Step 2.
Set fan end of unit and discharge end of unit in place.

Figure 20. Reassembly of Split Unit - Step 1


Remove top cap and save for step 3
Discharge end of Unit
Fan end of Unit
Remove screws on fan panel, but leave retainer clips in place; save screws for Step 3.
Remove plywood and retaining angles from unit and discard

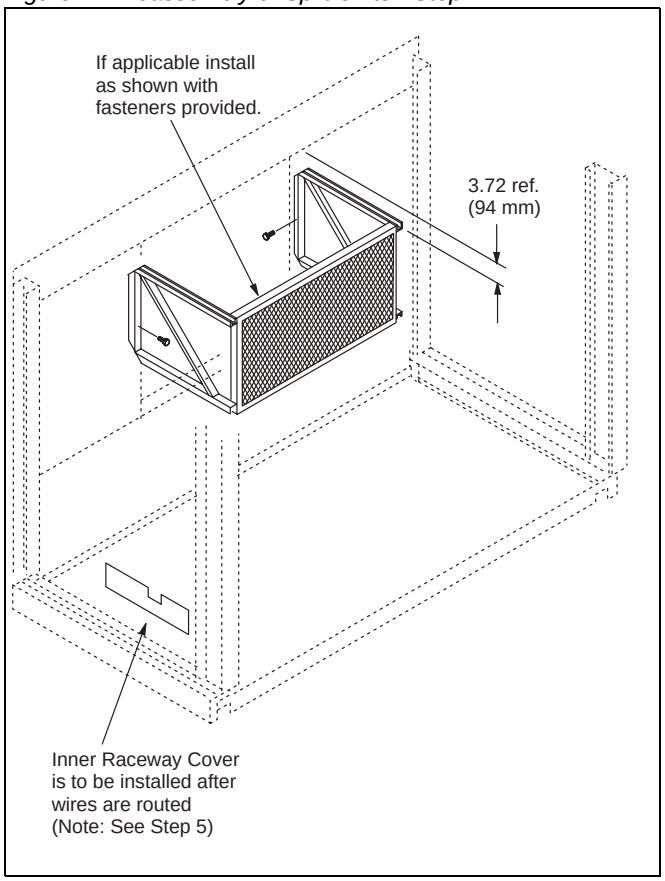
Step 3.
Caulk and install parts as shown in *Figure 21*.

Figure 21. Reassembly of Split Units - Step 3



Step 4.
Install Raceway Cover as shown in *Figure 22*.

Figure 22. Reassembly of Split Units - Step 4



Note: Use the diffuser in a blank heat section or in a steam heat and hot water heat section only.

Step 5.
Make electrical connections.

Installing Ductwork

On bottom-supply/bottom-return units, the installing contractor should make an airtight connection. Attach field fabricated duct collars to the bottom surface of either the roof curb's duct flange or the unit's duct opening if a McQuay roof curb is not used. Do not support the total weight of the ductwork from the unit or these duct flanges. *Refer to Figure 23*.

Units with optional back return, side discharge, or end discharge (on RFS units) all have duct collars provided. The discharge duct collars on a side discharge unit are exposed by removing the plenum section access door and the door gasketing.

Use flexible connections between the unit and ductwork to avoid transmission of vibration from the unit to the structure.

Design ductwork per ASHRAE and SMACNA recommendations to minimize losses and sound transmission.

Where return air ducts are not required, connect a sound absorbing T or L section to the unit return to reduce noise transmission to the occupied space.

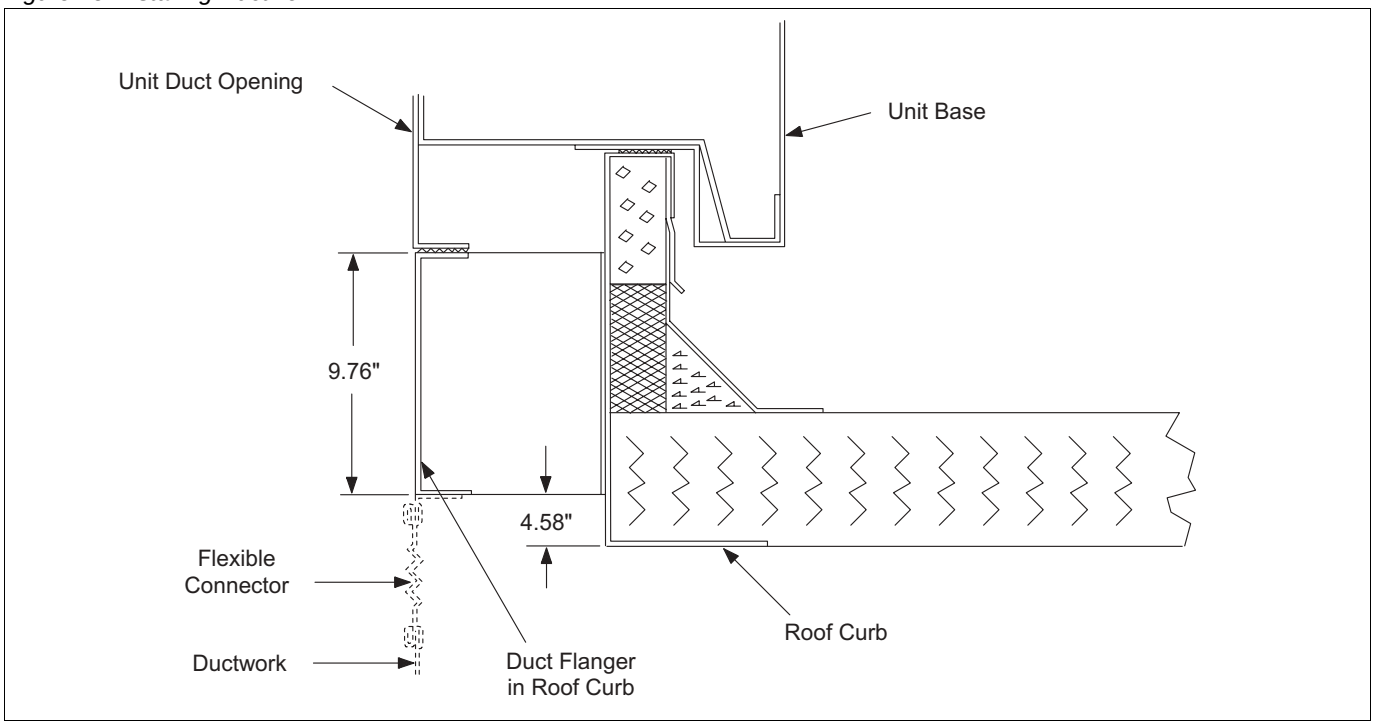
Build ductwork exposed to outdoor conditions in accordance with ASHRAE and SMACNA recommendations and local building codes.

NOTICE

Installer must provide access in the ductwork for plenum mounted controls.

On units with side discharge, access to plenum mounted components becomes difficult once ductwork is installed.

Figure 23. Installing Ductwork



Installing Duct Static Pressure Sensor Taps

For all VAV units, duct static pressure taps must be field installed and connected to the pressure sensors in the unit. Sensor SPS1 is standard; additional sensor SPS2 is optional. These sensors are located at the bottom of the main control panel next to terminal block TB2 *(see "Control Panel Locations" on page 9).*

The duct static pressure sensing tap must be carefully located and installed. Improper location or installation of the sensing tap will cause unsatisfactory operation of the entire variable air volume system. Following are pressure tap location and installation recommendations. The installation must comply with local code requirements

.

⚠ CAUTION

Fragile sensor fittings.
May damage pressure sensor.

If tubing must be removed from a pressure sensor fitting, use care. Do not wrench the tubing back and forth to remove or the fitting may break off.

1. Install a tee fitting with a leak-tight removable cap in each tube near the sensor. This will facilitate connecting a manometer or pressure gauge if testing is required.
2. Use different colored tubing for the duct pressure (HI) and reference pressure (LO) taps, or tag the tubes.

3. Locate the duct pressure (HI) tap near the end of a long duct to verify that all terminal box take-offs along the run will have adequate static pressure.
4. Locate the duct tap in a nonturbulent flow area of the duct. Keep it several duct diameters away from take-off points, bends, neckdowns, attenuators, vanes, or other irregularities.
5. Use a static pressure tip (Dwyer A302 or equivalent) or the bare end of the plastic tubing for the duct tap. (If the duct is lined inside, use a static pressure tip device.)
6. Install the duct tap so that it senses only static pressure (not velocity pressure). If an L-shaped pressure tip device is used, the point must face the airstream. If a bare tube end is used, it must be smooth, square (not cut at an angle), and perpendicular to the airstream. *(see Figure 25).*
7. Locate the reference pressure (LO) tap somewhere near the duct pressure tap within the building (*see Figure 24*). If the reference tap is not connected to the sensor, unsatisfactory operation will result.
8. Route the tubes between the curb and the supply duct, and feed them into the unit through the knockout in the bottom of the control panel *(see Figure 24).* Connect the tubes to the appropriate 1/8 inch fittings on the sensors. Make sure that the sensors do not support the weight of the tubing; use tube clamps or some other means.

Figure 24. Static Pressure Tubing Entrance Location

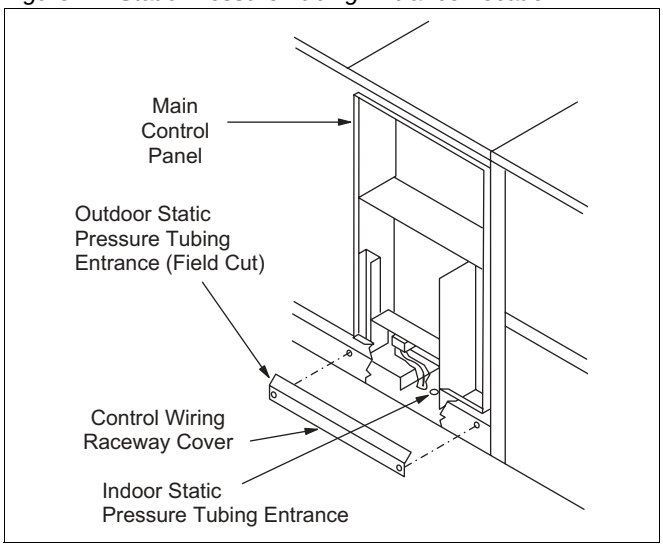
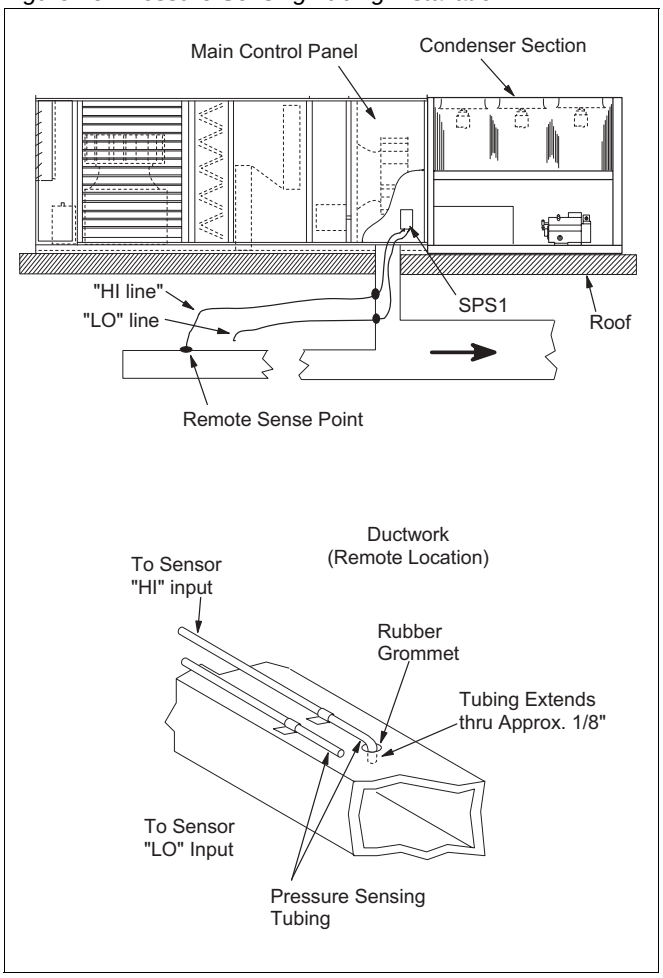


Figure 25. Pressure Sensing Tubing Installation



Installing Building Static Pressure Sensor Taps

If a unit has direct building static pressure control capability, static pressure taps must be field installed and connected to pressure sensor SPS2 in the unit. This sensor is located at the bottom of the main control panel next to terminal block TB2 (see "Control Panel Locations" in the "Unit Description" section of this manual).

The two static pressure sensing taps must be carefully located and installed. Improper location or installation of the sensing taps will cause unsatisfactory operation. Following are pressure tap location and installation recommendations for both building envelope and lab, or "space within a space," pressure control applications. The installation must comply with local code requirements.

⚠ CAUTION

Fragile sensor fittings.
May damage pressure sensor.

If tubing must be removed from a pressure sensor fitting, use care. Do not wrench the tubing back and forth to remove or the fitting may break off.

Building Pressurization Applications

1. Install a "T" fitting with a leak-tight removable cap in each tube near the sensor. This will facilitate connecting a manometer or pressure gauge if testing is required.
2. Locate the building pressure (HI) tap in the area that re quires the closest control. Typically, this is a ground level floor that has doors to the outside.
3. Locate the building tap so that it is not influenced by any source of moving air (velocity pressure). These sources may include air diffusers or outside doors.
4. Route the building tap tube between the curb and the supply duct, and feed it into the unit through the knockout in the bottom of the control panel (*see Figure 24 on page 23*). Connect the tube to the V4 inch HI fitting on sensor SPS2. The sensor must not support the weight of the tubing; use tube clamps or some other means.
5. Locate the reference pressure (LO) tap on the roof. Keep it away from the condenser fans, walls, or anything else that may cause air turbulence. Mount it high enough above the roof so that it is not affected by snow. If the reference tap is not connected to the sensor, unsatisfactory operation will result.
6. Use an outdoor static pressure tip (Dwyer A306 or equivalent) to minimize the adverse effects of wind. Place some type of screen over the sensor to keep out insects. Loosely packed cotton works well.
7. Route the outdoor tap tube out of the main control panel through a small field-cut opening in the edge of the control wiring raceway cover (*see Figure 24 on page 23*). Cut this "mouse hole" in the vertical portion of the edge. Seal the penetration to prevent water from entering. Connect the tube to the 1/4 inch LO fitting on sensor SPS2.

Lab Pressurization Applications

1. Install a ”T” fitting with a leak-tight removable cap in each tube near the sensor. This will facilitate connecting a manometer or pressure gauge if testing is required.
2. Use different colored tubing for the controlled space pressure (HI) and reference pressure (LO) taps, or tag the tubes.
3. Regardless of whether the controlled space is positive or negative with respect to its reference, locate the HI pressure tap in the controlled space. (The setpoint can be set between -0.2 and 0.2" W.C.)
4. Locate the reference pressure (LO) tap in the area surrounding the controlled space. If the reference tap is not connected to the sensor, unsatisfactory operation will result.
5. Locate both taps so that they are not influenced by any source of moving air (velocity pressure). These sources may include air diffusers or doors between the high and low pressure areas.
6. Route the tap tubes between the curb and the supply duct, and feed them into the unit through the knockout in the bottom of the control panel (see *Figure 24 on page 23*).
7. Connect the tubes to the appropriate ¼ inch fittings on sensor SPS2. The sensor must not support the weight of the tubing; use tube clamps or some other means.

Condensate Drain Connection

The unit is provided with a 1.5" male NPT condensate drain connection. *Refer to certified drawings* for the exact location. The unit and drain pan must be level side to side and a P-trap must be installed for proper drainage.

Units may have positive or negative pressure sections. It is recommended that traps be used in both cases with care given to negative pressure sections. In *Figure 26 on page 25*, dimension "A" should be a minimum of 8" (203 mm). As a conservative measure to prevent the cabinet static pressure from blowing or drawing the water out of the trap and causing air leakage, dimension "A" should be two times the maximum static pressure encountered in the coil section in inches w.c.

Drainage of condensate directly onto the roof may be acceptable; refer to local codes. It is recommended that a small drip pad of either stone, mortar, wood or metal be provided to protect the roof against possible damage.

If condensate is to be piped into the building drainage system, pitch the drain line away from the unit at a minimum of 1/8" per foot. The drain line must penetrate the roof external to the unit. Refer to local codes for additional requirements. Sealed drain lines require venting to provide proper condensate flow.

Where the cooling coils have intermediate condensate pans on the face of the evaporator coil, copper tubes near both ends of the coil provide drainage to the main drain pan. Check that the copper tubes are in place and open before the unit is put into operation.

On units with staggered cooling coils, the upper drain pan drains into the lower coil drain pan through a copper tube near the center of the drain pan. Check that this tube is open before putting the unit into operation and as part of routine maintenance.

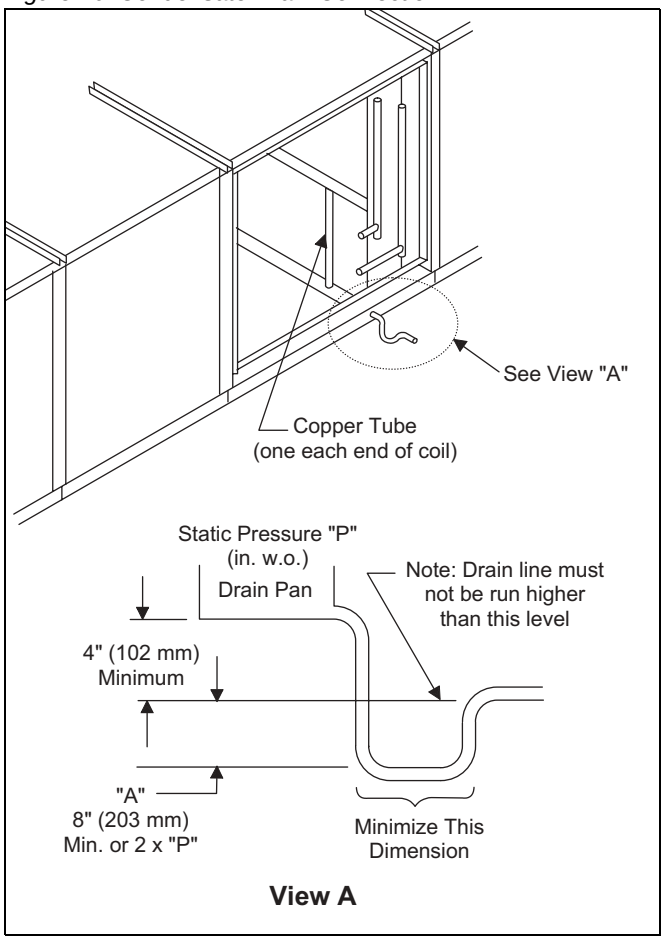
Because drain pans in any air conditioning unit will have some moisture in them, algae, etc. will grow. Periodic cleaning is necessary to prevent this buildup from plugging the drain and causing the drain pan to overflow. Keep the drain pans clean to prevent the spread of disease. Cleaning should be performed by qualified personnel.

⚠ WARNING

Clean drain pans regularly. Growth in uncleaned drain pans can cause disease.

Cleaning must be done by trained and experienced personnel.

Figure 26. Condensate Drain Connection



Field Refrigerant Piping and Charging of DX Coils

Units that ship from the factory with DX coils installed do not include refrigerant piping or refrigerant controls. The coil assembly is ready for field connections at the distributors and at the suction headers. Piping kits that provide the necessary liquid and hot gas piping and control components are available for field installation. Field installed refrigerant piping may exit the unit cabinet at one of the following locations:

1. Through the floor of the unit.
2. Through the discharge and bulkhead of the unit.
3. Through a cabinet door near the DX coil that is not required for service areas.

⚠ CAUTION

For any of the above cabinet penetrations, the hole must be tightly sealed to prevent water or air leakage.

In preparing for field piping, the plastic plugs on the distributors must be removed and the copper caps at the suction header connections must be unsweated.

Follow piping design, sizing, and installation information presented in ASHRAE handbooks in the design and installation of interconnecting piping. The DX coil and condensing unit are intended to be set at the same elevation, as close as possible to each other to minimize refrigerant pressure drop. Design piping to prevent liquid refrigerant carryover to the compressor and to provide a continuous return of compressor oil from the system.

⚠ CAUTION

The pounds of refrigerant in the system may exceed the capacity of the condenser, depending on the amount of refrigerant in the liquid lines between the DX coil and the condensing unit.

Refer to condenser manufacturer for information about refrigerant capacity. Suitable means of containing the refrigerant is required.

⚠ CAUTION

On systems with optional hot gas bypass, it is important the bypass solenoid valve be located at the condensing unit and not at the DX coil to prevent liquid return and damage to the compressor.

Piping Recommendations

1. Use type K or L clean copper tubing. Clean and braze all joints thoroughly with high temperature solder.
2. Base piping sizes on temperature/pressure limitations as recommended in the following paragraphs. Under no circumstances base pipe size strictly upon coil or condensing unit piping connection size.
3. Suction line piping pressure drop should not exceed the pressure equivalent of 2°F (1°C), 3 psi (20.7 kPa) per 100 feet (30.5 m) of equivalent pipe length. After the suction line size has been determined, check the vertical suction risers to verify that oil will be carried up the riser and back to the compressor. Pitch the suction line(s) in the direction of refrigerant flow and support adequately. Lines should be free draining and fully insulated between the evaporator and the compressor.
4. Check vertical suction risers to determine the minimum tonnage required to carry oil up suction risers of various sizes.
5. Insulate suction lines inside the unit cabinet to prevent condensation.
6. Size the liquid line for a pressure drop not to exceed the pressure equivalent of 2°F (1°C), 6 psi (41.4 kPa) saturated temperature.

Table 5: Minimum tonnage (R-22) to carry oil up suction riser at 40°F saturated suction

LINE SIZE O.D.	1-1/8"	1-3/8"	1-5/8"	2-1/8"	2-5/8"	3-1/8"	3-5/8"	4-1/8"
MIN. TONS	1.5	2.5	3.8	7.6	13.10	20.4	29.7	41.3

Leak Testing

In the case of loss of the nitrogen holding charge, check the unit for leaks prior to charging the complete system. Leak testing must be done to current EPA standards and regulations. After making any necessary repair, evacuate the system as described in the following paragraphs.

⚠ WARNING

Do not use oxygen to build up pressure.

Using oxygen to build up pressure can cause an explosion, resulting in severe personal injury or death.

Evacuation

After it has been determined that the unit is tight and there are no refrigerant leaks, evacuate the system. Use a vacuum pump with a pumping capacity of approximately 3 cu.ft./min. and the ability to reduce the vacuum in the unit to at least 1 millimeter (1000 microns).

1. Connect a mercury manometer or other type of micron gauge to the unit at a point remote from the vacuum pump. For readings below 1 millimeter, use an electronic or other micron gauge.
2. The triple evacuation method is recommended and is particularly helpful if the vacuum pump is unable to obtain the desired 1 millimeter of vacuum. The system is first evacuated to approximately 29" (740 mm) of mercury. Enough refrigerant vapor is then added to the system to bring the pressure up to 0 pounds (0 microns).
3. Then the system is once again evacuated to 29" (740 mm) of vacuum. This procedure is repeated three times. This method can be most effective by holding system pressure at 0 pounds (0 microns) for a minimum of 1 hour between evacuations. The first pulldown will remove about 90% of the noncondensables, the second about 90% of that remaining from the first pulldown, after the third, only 1/10 of 1% of noncondensables will remain.

Table 6 shows the relationship between pressure, microns, atmospheres, and the boiling point of water.

To service liquid line components, the manual shutoff valve is closed and refrigerant is pumped into the condenser.

Table 6: Pressure Vacuum Equivalents

ABSOLUTE PRESSURE ABOVE ZERO		VACUUM BELOW 1 ATMOSPHERE		APPROXIMATE FRACTION OF 1 ATMOSPHERE	BOILING POINT OF H2O AT EACH PRESSURE °F (°C)
MICRONS	PSIA	MERCURY (MM)	MERCURY (IN.)		
0	0	760.00	29.921	—	—
50	0.001	759.95	29,920	1/15,200	- 50 (-45)
100	0.002	759.90	29.920	1/7,600	- 40 (-40)
150	0.003	759.85	29.920	1/5,100	- 33 (-36)
200	0.004	759.80	29.910	1/3,800	- 28 (-33)
300	0.006	759.70	29.910	1/2,500	- 21 (-29)
500	0.009	759.50	29.900	1/1,520	- 12 (-24)
1,000	0.019	759.00	29.880	1/760	1 (-17)
2000	0.039	758.00	29.840	1/380	15 (-9)
4,000	0.078	756.00	29.760	1/189	29 (-2)
6000	0.117	754.00	29.690	1/127	39 (4)
8,000	0.156	752.00	29.600	1/95	46 (8)
10,000	0.193	750.00	29.530	1/76	52 (11)
15,000	0.290	745.00	29.330	1/50	63 (17)
20,000	0.387	740.00	29.130	1/38	72 (22)
30,000	0.580	730.00	28.740	1/25	84 (29)
50,000	0.967	710.00	27.950	1/15	101 (38)
100,000	1.930	660.00	25.980	2/15	125 (52)
200,000	3.870	560.00	22.050	1/4	152 (57)
500,000	9.670	260.00	10.240	2/3	192 (89)
760,000	14.697	0	0	1 Atmosphere	212 (100)

Charging the System

RCS units are leak tested at the factory and shipped with a nitrogen holding charge. If the holding charge has been lost due to shipping damage, charge the system with enough refrigerant to raise the unit pressure to 30 psig after first repairing the leaks and evacuating the system.

1. After all refrigerant piping is complete and the system has been evacuated, charge it as described in the following paragraphs. Connect the refrigerant drum to the gauge port on the liquid shutoff valve, and purge the charging line between the refrigerant cylinder and the valve. Then open the valve to the midposition.
2. If the system is under a vacuum, stand the refrigerant drum with the connection up, open the drum and break the vacuum with refrigerant gas.
3. With a system gas pressure higher than the equivalent of a freezing temperature, invert the charging cylinder and elevate the drum above the condenser. With the drum in this position and the valves open, liquid refrigerant will flow

into the condenser. Approximately 75% of the total requirement estimated for the unit can be charged in this manner.

4. After 75% of the required charge has entered the condenser, reconnect the refrigerant drum and charging line to the suction side of the system. Again purge the connecting line, stand the drum with the connection side up, and place the service valve in the open position.

Important: At this point, interrupt the charging procedure and do prestart checks before attempting to complete the refrigerant charge.

Note: Stamp the total operating charge on the unit nameplate for future reference.

Refrigerant Charge

Factory installed DX coils are designed to use R-22. The total system charge is the sum of these three values:

1. Condensing unit charge. Refer to manufacturer's data.
2. Evaporator coil charge. Refer to *Table 7 and Table 8*.
3. Charge for the length of interconnecting piping installed by field. Refer to *Table 9*.

Note: Factory installed DX coils are intended for one refrigerant circuit on unit size 800 and two refrigerant circuits containing identical weights of refrigerant on all other sizes. The values shown in *Table 7, Table 8 and Table 9* are for each circuit.

Note: The total operating charge per circuit should not exceed the pumpdown capacity per circuit, specified by the condensing unit manufacturer.

Table 7: Approximate DX Coil Refrigerant Charge Per Circuit

Unit Size	DX Coil R-22 Charge (Lbs./Circuit)	
	Flat Coil	Staggered Coil
047C	3 x No. of DX Rows	3.5 x No. of DX Rows
077C	5 x No. of DX Rows	6.5 x No. of DX Rows

Table 8: Approximate Refrigerant Charge Per Circuit

Unit Size	Evaporator Coil (Lbs/Ckt/Coil Row)
802	3.30
802C*	2.45

* The RDS 802C unit has two refrigerant circuits

Table 9: Weight of refrigerant R-22 in copper lines (pounds per 100 feet of Type L tubing)

O.D. Line Size	VOL. Per 100 FT. In Cubic Feet	Weight of Refrigerant, Lbs./100 Feet			
		Liquid @100°F	Hot Gas @120°F Cond.	Suction Gas (Superheat to 85°F)	
				30°F	40°F
3/8"	0.054	3.84	0.202	0.052	0.077
1/2"	0.100	7.12	0.374	0.098	0.143
5/8"	0.162	7.12	0.605	0.158	0.232
7/8"	0.336	24.00	1.260	0.323	0.480
1-1/8"	0.573	40.80	2.140	0.550	0.820
1-3/8"	0.872	62.10	3.260	0.839	1.250
1-5/8"	1.237	88.00	4.620	1.190	1.770
2-1/8"	2.147	153.00	8.040	2.060	3.060
2-5/8"	3.312	236.00	12,400	3.180	4.720
3-1/8"	4.728	336.00	17.700	4.550	6.750
3-5/8"	6.398	456.00	24.000	6.150	9.140
4-1/8"	8.313	592.00	31.100	8.000	11.190

Unit Piping

Gas Piping

See the "Installation" section of the gas-fired furnace installation manual, Bulletin No. IM 684 or 685.

Fuel Oil Piping

See the "Installation" section of the gas-fired furnace installation manual, Bulletin No. IM 684 or IM 685.

Piping for Steam, Hot Water / ChIlled Water Coils

Factory installed chilled water coils are installed in a coil section which may be designed to accept a factory installed heating coil immediately upstream. The coil section may be ordered in either the draw-through or blow-through position. All chilled water piping can be done internal to the unit without requiring a piping vestibule (except on sizes 800-802 when heating coils are included in the cooling coil section).

Steam and hot water coils may be factory installed in either a heat section, or in the combination coil section. These sections may be located either in the draw-through or blow-through position. When a steam or hot water coil is installed in the heat section, all piping may be done internal to the unit without requiring a piping vestibule. *Refer to Figure 29* and *Figure 31 on page 30*.

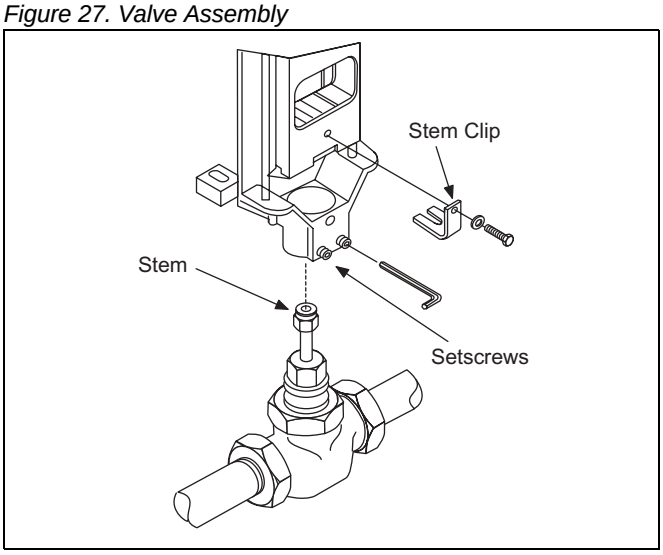
When a steam or hot water coil is installed in the combination coil section, the coil connections project to the inside surface of the door panel. Holes may be cut in the door panels for the piping to be connected to the coils, or an accessory piping vestibule may be added to the unit to provide piping space. Refer to the section on vestibule assembly instructions. The piping may then be routed back within the unit as shown in *Figure 29 on page 29*.

To avoid piping penetrations through the roof external to the curb, holes may be cut through the floor of the unit at the locations specified on the cer1ified drawings.

⚠ CAUTION

All holes in the unit floor must be sealed to prevent water leakage into the building.

Figure 27. Valve Assembly



Note: The valve actuator spring returns to a stem up position upon power failure. This allows full flow through the coil.

⚠ CAUTION

Coil freeze possible. May damage equipment.

Carefully read instructions for mixing the antifreeze solution. Some products will have higher freezing points in their natural state than when mixed with water. The freezing of coils is not the responsibility of McOuay International. Refer 10 "Winterizing Coils" in the "Maintenance" section of the manual.

Hot Water Piping (All Units)

Note: If an iron valve is installed in the unit, connecting to a copper piping system will likely cause galvanic corrosion to occur and the valves will not last. All coils have vents and drains factory installed.

Hot water coils are not normally recommended for use with entering air temperatures below 40°F (4°C). No control system can be depended on to be 100% safe against freeze-up with water coils. Glycol solutions or brines are the only freeze-safe media for operation of water coils for low entering air conditions. Refer to the "Maintenance" section of this manual for more on winterizing coils. The hot water section consists of two stacked coils, as shown in *Figure 28*. When no factory piping or valve is included, the coil connections are 2.12" ODM copper.

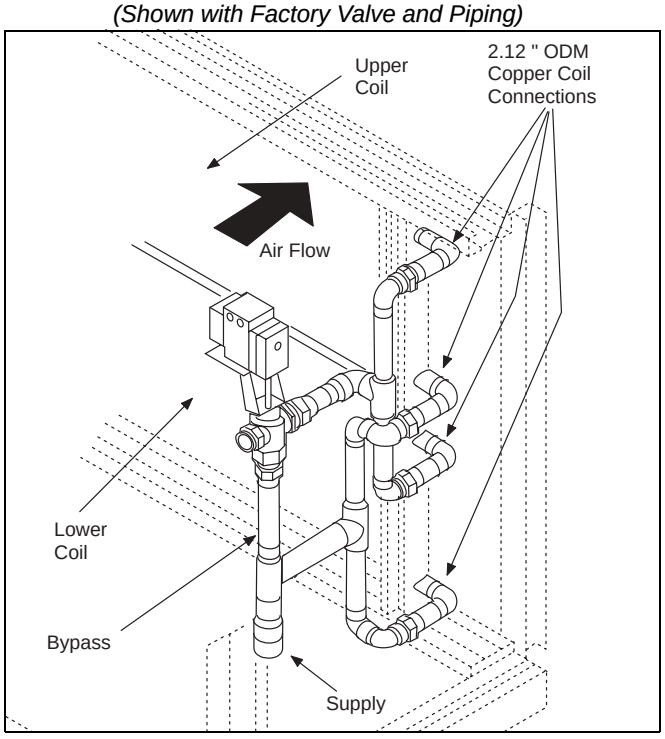
Hot Water Piping to Coils In the Heat Section

Hot water coils are provided without valves for field piping, or piped with three-way valves with actuator motors.

With the factory piping and valve package, the two coils are piped in parallel and controlled through a single three-way valve. Field piping connections are of the same NPT size as the valve-male threads at the supply connection, female threads at the return connection.

Note: The valve actuator spring returns to a stem down position upon power failure. This allows full flow through the coil.

Figure 28. Hot Water Heat Section (Shown with Factory Valve and Piping)

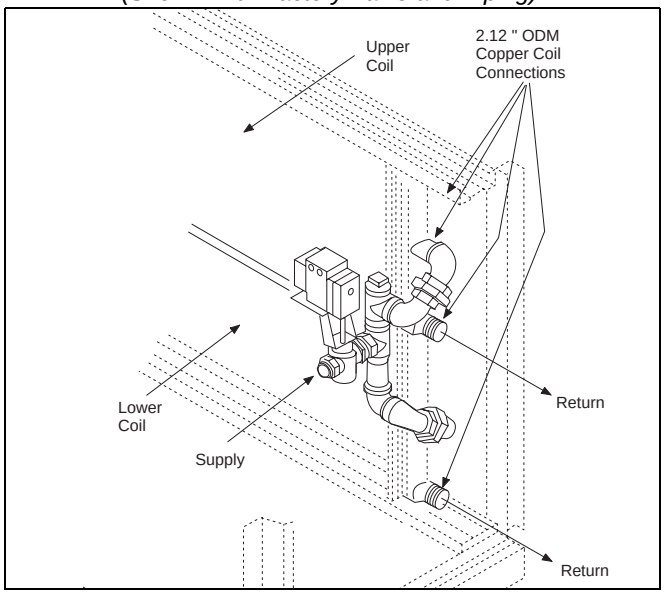


Steam Piping (All Units)

The steam heat section consists of two stacked coils (pitched at 1/811 per foot [3mm per 30cm]), as shown in *Figure 29*. When no factory piping or valve is included, the coil connections are 2.50" male NPT iron pipe.

Refer to the sections on steam coil piping and trap recommendations for additional information.

Figure 29. Steam Heat Section (Shown With Factory Valve and Piping)



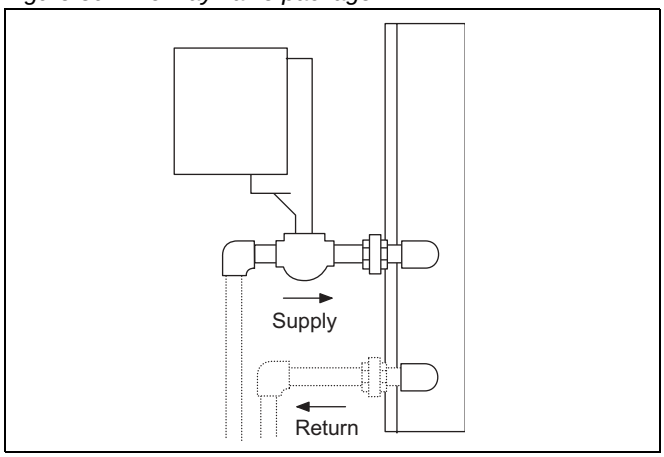
Steam Piping to Coils in the Heat Section

Steam coils are provided without valves for field piping, or piped with two-way valves and actuator motors.

With the factory piping and valve package, the two coil supplies are piped in parallel and controlled through a single two-way valve. The field supply connection is of the same female NPT size as the valve. Field return connections are made at the 2.50" male NPT fittings on each of the two stacked coils.

Note: The valve actuator spring returns to a stem up position upon power failure. This allows full flow through the coil.

Figure 30. Two-way valve package



Piping Recommendations (Steam Coils)

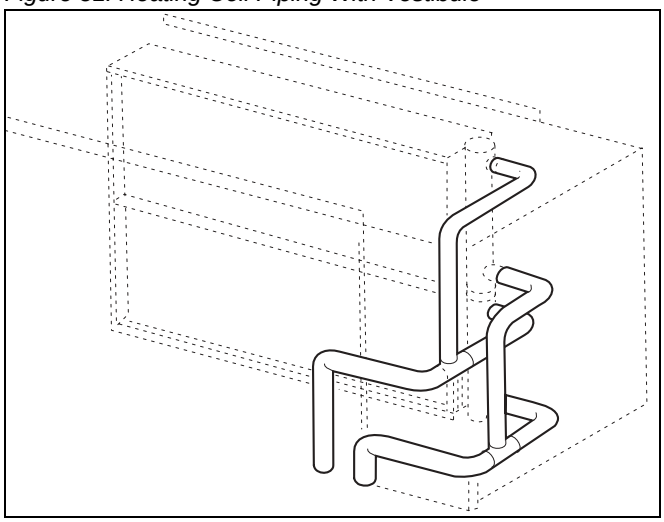
1. Be certain that adequate piping flexibility is provided. Stresses resulting from expansion of closely coupled piping and coil arrangement can cause serious damage.
2. Do not reduce pipe size at the coil return connection. Carry return connection size through the dirt pocket, making the reduction at the branch leading to the trap.
3. Install vacuum breakers on all applications to prevent retaining condensate in the coil. Generally, the vacuum breaker is to be connected between the coil inlet and the return main. However, if the system has a flooded return main, open the vacuum breaker to the atmosphere and the trap design to allow venting of the large quantities of air.
4. Do not drain steam mains or take-offs through coils. Drain mains ahead of coils through a steam trap to the return line.
5. Do not attempt to lift condensate when using modulating or on-off control.
6. Pitch all supply and return steam piping down a minimum of 1 inch per 10 feet (3mm per 305cm) in direction of flow.

Steam Trap Recommendations

1. Size traps in accordance with manufacturers' recommendations. Be certain that the required pressure differential will always be available. Do not undersize.

2. Float and thermostatic or bucket traps are recommended for low pressure steam. Use bucket traps on systems with on-off control only.
3. Locate traps at least 12 inches (305 mm) below the coil return connection.
4. Always install strainers as close as possible to the inlet side of the trap.
5. A single trap may generally be used for coils piped in parallel, but an individual trap for each coil is preferred.

Figure 31. Heating Coil Piping With Vestibule



Freeze Conditions Steam Coils
Entering air temperature below 35°F (2°C)

1. 5 PSI (34.5 kPa) steam must be supplied to coils at all times.
2. Modulating valves are not recommended. Use face and bypass dampers.
3. As additional protection against freeze-up, install the trap sufficiently far below the coil to provide an adequate hydrostatic head to remove condensate during an interruption on the steam pressure. Estimate 3 feet (914mm) for each 1 PSI (6.9 kPa) of trap differential required.
4. If the unit is to be operated in environments with possible freezing temperatures, an optional freezestat is recommended. Refer to "Freeze Protection" in the "Unit Options" section of this manual.

Chilled Water Piping

Chilled water coils are provided without valves for field piping, or piped with three-way valves with motor actuators. Table 8 provides information on units with factory installed piping and valve packages. The table also provides field sweat connection information for units not furnished with factory installed piping and valve packages.

With the factory piping and valve package, the coil assembly is controlled through a single three-way valve. When two coils are included in the assembly, they are piped in parallel. Field connections are male NPT, sized as shown in Table 8. Refer to *Figure 32* for a typical cooling coil with factory valve and piping.

Figure 32. Chilled Water Coil
(Shown With Factory Valve and Piping)

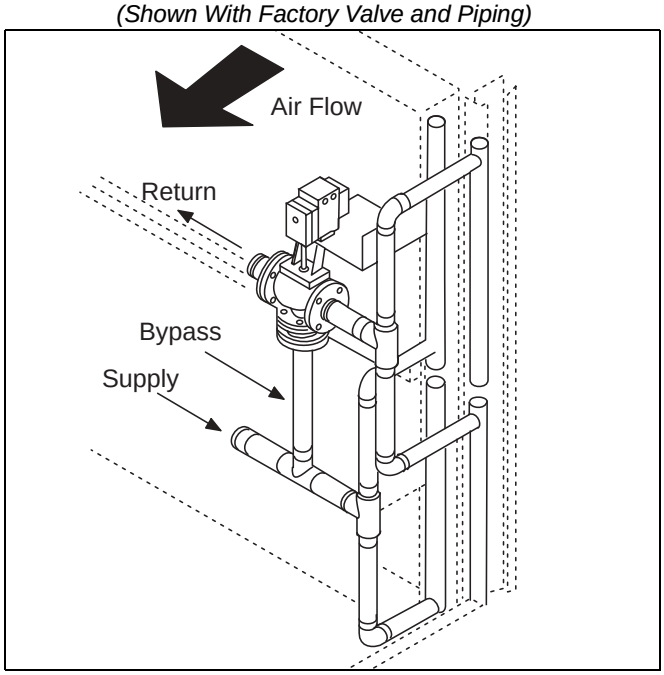


Table 10: Piping Connection Sizes / Valve Size Options For Chilled Water Piping

Cabinet Size	Application Code	Coil Size H x 83" (2108 mm) Long	Face Area Sq. Ft. (Sq. m)	Available Rows **	Available Circuiting									
					5WH		5WL		5WS		5WM		5WD	
					Columns*									
					1	2	1	2	1	2	1	2	1	2
047C	Blow-thru or Draw-thru Small Coil Section	33 + 33 (2 coils) (838 + 838 mm)	38.0 (3.53 m²)	3	D	R	D	Q	—	—	A	Q	A	P
				4	D	R	D	Q	B	Q	B	Q	B	P
				5	D	R	D	Q	—	—	B	Q	A	P
				6	D	R	D	Q	B	Q	B	Q	A	P
				8	D	R	D	Q	B	Q	B	Q	B	P
	Blow-thru or Draw-thru Large Coil Section	39 + 39 (2 coils) (991 + 991 mm)	45.0 (4.18 m²)	3	D	R	C	Q	—	—	A	Q	A	P
				4	D	R	C	Q	C	Q	C	Q	B	P
				5	D	R	C	Q	—	—	C	Q	A	P
				6	D	R	C	Q	C	Q	C	Q	A	P
				8	D	R	C	Q	C	Q	C	Q	B	P
	Face and Bypass Section With Small Coil	48 (1219 mm)	27.7 (2.57 m²)	3	F	U	E	T	—	—	A	S	A	S
				4	F	U	E	T	C	S	C	S	C	S
				5	F	U	E	T	—	—	C	S	A	S
				6	F	U	E	T	C	S	C	S	A	S
				8	F	U	E	T	C	S	C	S	C	S
	Face and Bypass Section With Large Coil	39 + 39 (2 coils) (991 + 991 mm)	45.0 (4.18 m²)	3	D	R	C	Q	—	—	A	Q	A	P
				4	D	R	C	Q	C	Q	C	Q	B	P
				5	D	R	C	Q	—	—	C	Q	A	P
				6	D	R	C	Q	C	Q	C	Q	A	P
				8	D	R	C	Q	C	Q	C	Q	B	P
077C	Blow-thru or Draw-thru Small Coil Section	45 + 45 (2 coils) (1143 + 1143 mm)	51.9 (4.82 m²)	3	C	R	C	Q	—	—	A	P	A	P
				4	C	R	C	Q	C	P	B	P	B	P
				5	C	R	C	Q	—	—	B	P	A	P
				6	C	R	C	Q	C	P	B	P	A	P
				8	C	R	C	Q	C	P	B	P	B	P
	Blow-thru or Draw-thru Large Coil Section	63 + 63 (2 coils) (1600 + 1600 mm)	72.6 (6.74 m²)	3	B	Q	B	P	—	—	A	P	A	P
				4	B	Q	B	P	B	P	B	P	B	P
				5	B	Q	B	P	—	—	B	P	A	P
				6	B	Q	B	P	B	P	B	P	A	P
				8	B	Q	B	P	B	P	B	P	B	P
	Face and Bypass Section With Small Coil	63 (1600 mm)	36.3 (3.37 m²)	3	E	T	C	S	—	—	A	S	A	S
				4	E	T	C	S	C	S	C	S	C	S
				5	E	T	C	S	—	—	C	S	A	S
				6	E	T	C	S	C	S	C	S	A	S
				8	E	T	C	S	C	S	C	S	C	S
	Face and Bypass Section With Large Coil	54 + 54 (2 coils) (1372 + 1372 mm)	62.3 (5.74 m²)	3	C	R	C	Q	—	—	A	P	A	P
				4	C	R	C	Q	B	P	B	P	B	P
				5	C	R	C	Q	—	—	B	P	A	P
				6	C	R	C	Q	B	P	B	P	A	P
				8	C	R	C	Q	B	P	B	P	B	P
800 or 802	Blow-thru or Draw-thru Cooling Only Coil Section	48 + 78 (1220 + 1981 mm)	26.0 (2.42 m²)	3	G	T	G	T	—	—	—	—	—	—
				4	G	T	G	T	G	T	—	—	—	—
				5	G	T	G	T	—	—	—	—	—	—
				6	G	T	G	T	G	T	—	—	—	—
	Blow-thru or Draw-thru Unit Coil Section	48 + 78 (1220 + 1981 mm)	26.0 (2.42 m²)	3	G	T	G	T	—	—	—	—	—	—
				4	G	T	G	T	G	T	—	—	—	—
				5	G	T	G	T	—	—	—	—	—	—
				6	G	T	G	T	G	T	—	—	—	—
	Face and Bypass Section With Small Coil	30 + 79 (763 + 2006 mm)	16.5 (2.57 m²)	3	—	L	—	M	—	—	—	N	—	N
				4	—	L	—	M	—	M	—	N	—	N
				5	—	L	—	M	—	—	—	N	—	N
				6	—	L	—	M	—	M	—	N	—	N
				8	—	L	—	M	—	M	—	N	—	N
				10	—	L	—	M	—	—	—	N	—	N
	Blow-thru or Draw-thru Contractor Coil Section	36 + 79 (915 + 2006 mm)	19.8 (4.18 m²)	3	—	L	—	M	—	K	—	N	—	N
				4	—	L	—	M	—	—	—	N	—	N
				5	—	L	—	M	—	K	—	N	—	N
				6	—	L	—	M	—	K	—	N	—	N
				8	—	L	—	M	—	K	—	N	—	N
				10	—	L	—	M	—	K	—	N	—	N

** Available with 8, 10 or 12 fins per inch.

*** Columns 1 and 2 are explained on page 32.**

Table 10 Available Circuiting Legend

Column 1:

These units are available with a factory installed package consisting of a three-way water valve and connecting piping.

A = This combination is not available with a factory installed piping and valve package.

B = 300, 2.50, or 200 inch three-way valves can be specified

C = 300, 2.50, 2.00, or 150 inch three-way valves can be specified

D = 250, 200, or 150 inch three-way valves can be specified

E = 250, 200, 150, or 1.25 inch three-way valves can be specified

F = 200, 1.50, or 125 inch three-way vales can be specified

G = 1.25, 1.50, 2.00 or 2.50 inch three-way valves can be specified

Field supply and return female NPT connection sizes are the same as the valve size.

Column 2:

The following letters designate units that are not furnished with the factory installed piping/valve package. Required are field sweat connections, at one or two coils, to male copper tubing for the supply and return water piping.

K = A single 2.00 inch NPT supply and return if fin height is 21 - 30 inches and 2.50 inches of fin height is 30 - 36 inches.

L = A single 1.50 inch NPT supply and return

M = A single 2.00 inch NPT supply and return if fin height is 21 - 30 inches

N = A single 2.50 inch NPT supply and return

P = Two 3.12 inch O.D. supply and two 3.12 O.D. return connections

Q = Two 2.62 inch O.D supply and two 2.62 O.D. return connections

R = Two 2.12 inch O.D. supply and two 2.12 O.D. return connections

S = One 3.12 inch O.D supply and one 3.12 O.D. return connections

T = One 2.62 inch O.D supply and one 2.62 O.D. return connections

U = One 2.12 inch O.D supply and one 2.12 O.D. return connections

Vestibule Assembly Instructions

An accessory vestibule is available to provide additional piping space for coils installed in a four-foot section. A vestibule is required to maintain door access on a combination heating and cooling section. Assemble the vestibule to the unit part by part as shown in *Figure 33*.

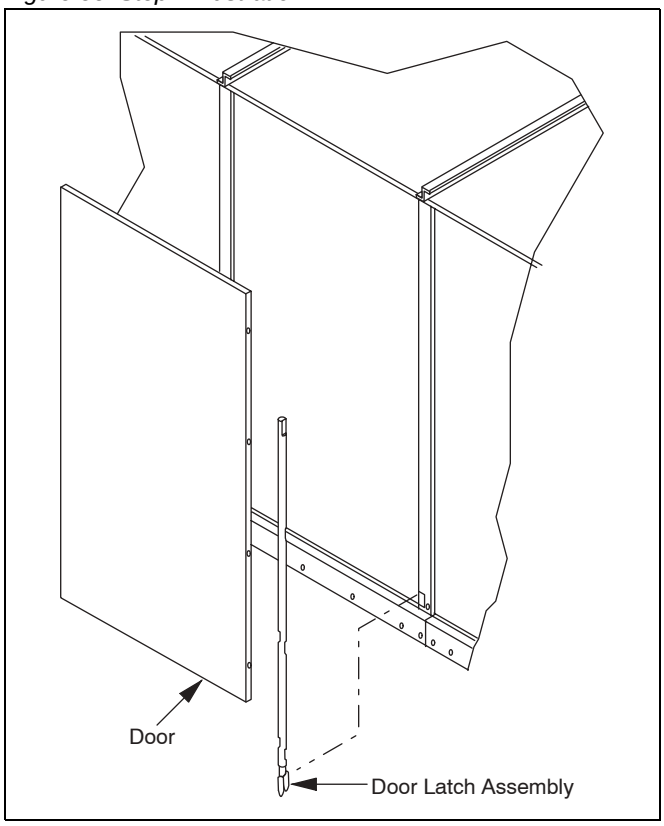
Note: The door, hinge, and latch assemblies from the unit are used on the vestibule.

Step 1

Remove door from section where vestibule is to be located by removing screws holding hinges to upright support (leave hinges on door). Set door aside and save for Step 4.

Remove door latch assembly from other side upright support. Use offset Phillips screwdriver or a wrench to remove screws holding latch assembly in place. Save door latch assembly, screws and bushings for Step 4.

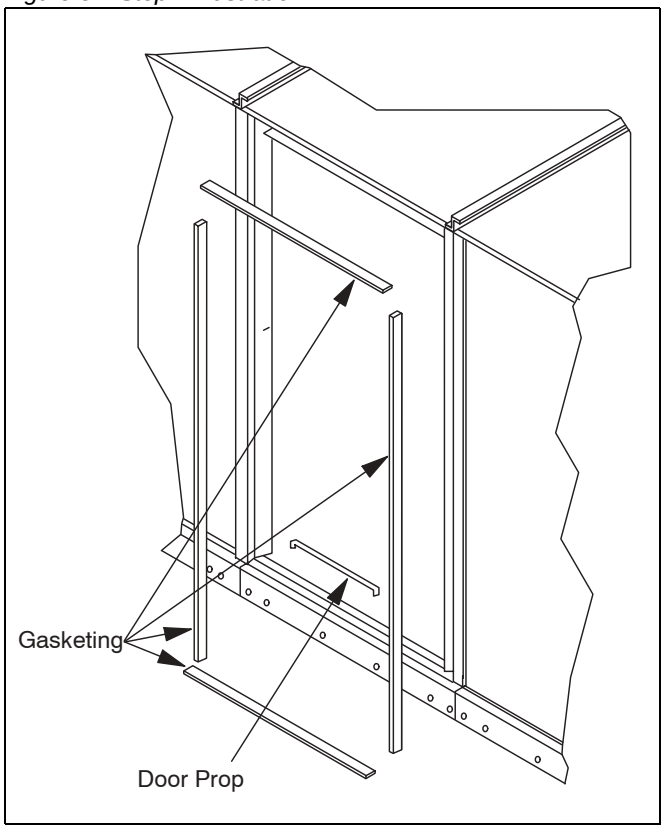
Figure 33. Step 1 Illustration



Step 2

Remove gasketing around door flange and save for use on vestibule. See Step 4. Remove door and save for Step 4.

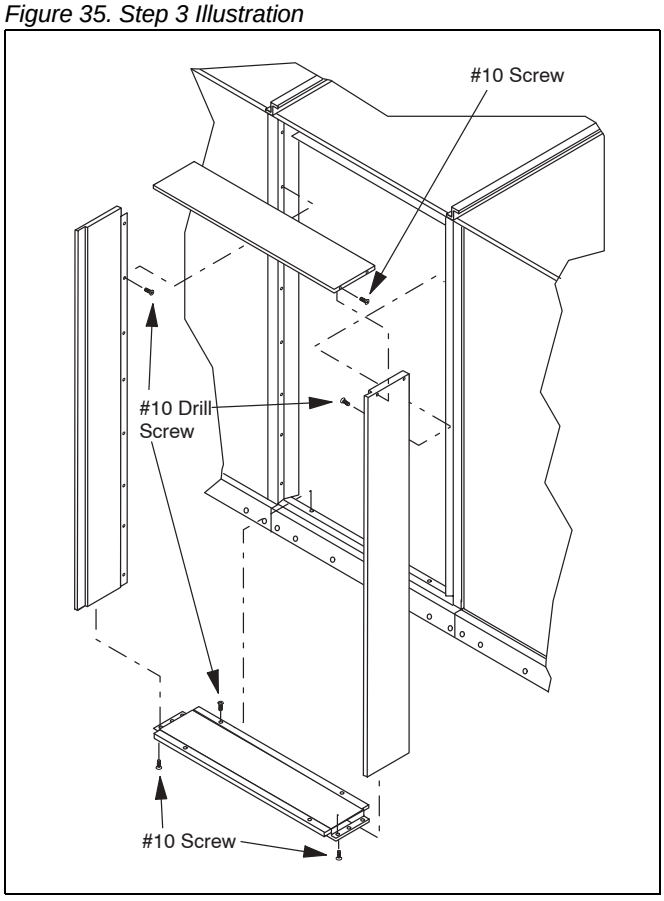
Figure 34. Step 2 Illustration



Step 3

1. Assemble side panels A and B to uprights using #10 drill screws supplied. Make certain side panels are flush against uprights before securing into place.
2. Fasten bottom panel D to base channel using #10 drill screws and to side panels A and B using #10 screws supplied.
3. Set top panel C in place and fasten to side panels A and B using #10 screws and to top panel using #10 screws supplied.

Figure 35. Step 3 Illustration

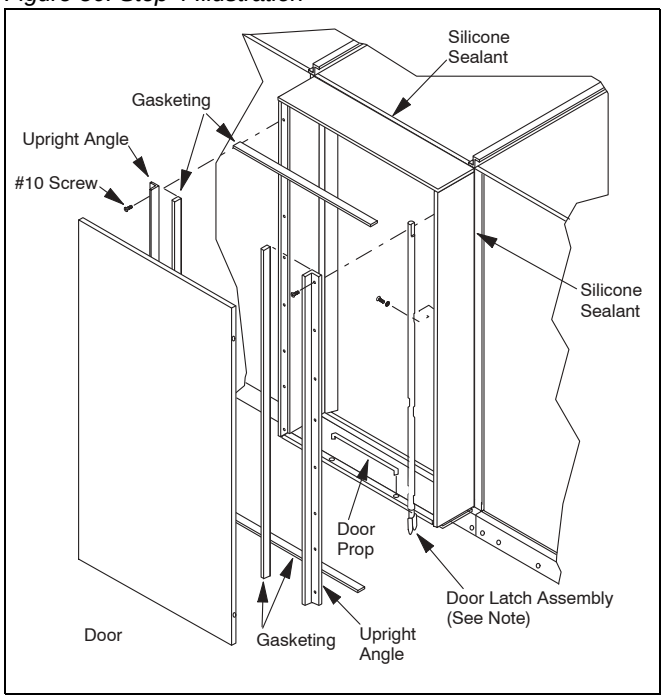


Step 4

1. Reassemble access door to vestibule by screwing hinges into side panel using screws saved from Step 1. (Access door must be attached to the vestibule in the same opening direction as it was on the unit.)
2. Remove and discard latch handle locking screws and retaining washer. Fasten door latch assembly to side panel using screws and bushings saved from Step 1. (Latch must be fastened on the same side as when located on the unit.)
3. Fasten upright angles to vestibule using #10 screws supplied.
4. Seal between unit and vestibule with silicone sealant along top and sides as shown.

Note: Any holes cut in the floor of the unit must be sealed to prevent water leakage.

Figure 36. Step 4 Illustration



Damper Assemblies

The optional damper assemblies described in this section are provided with manually adjustable linkages, or may be shipped with factory installed actuators and linkages in units that include factory controls.

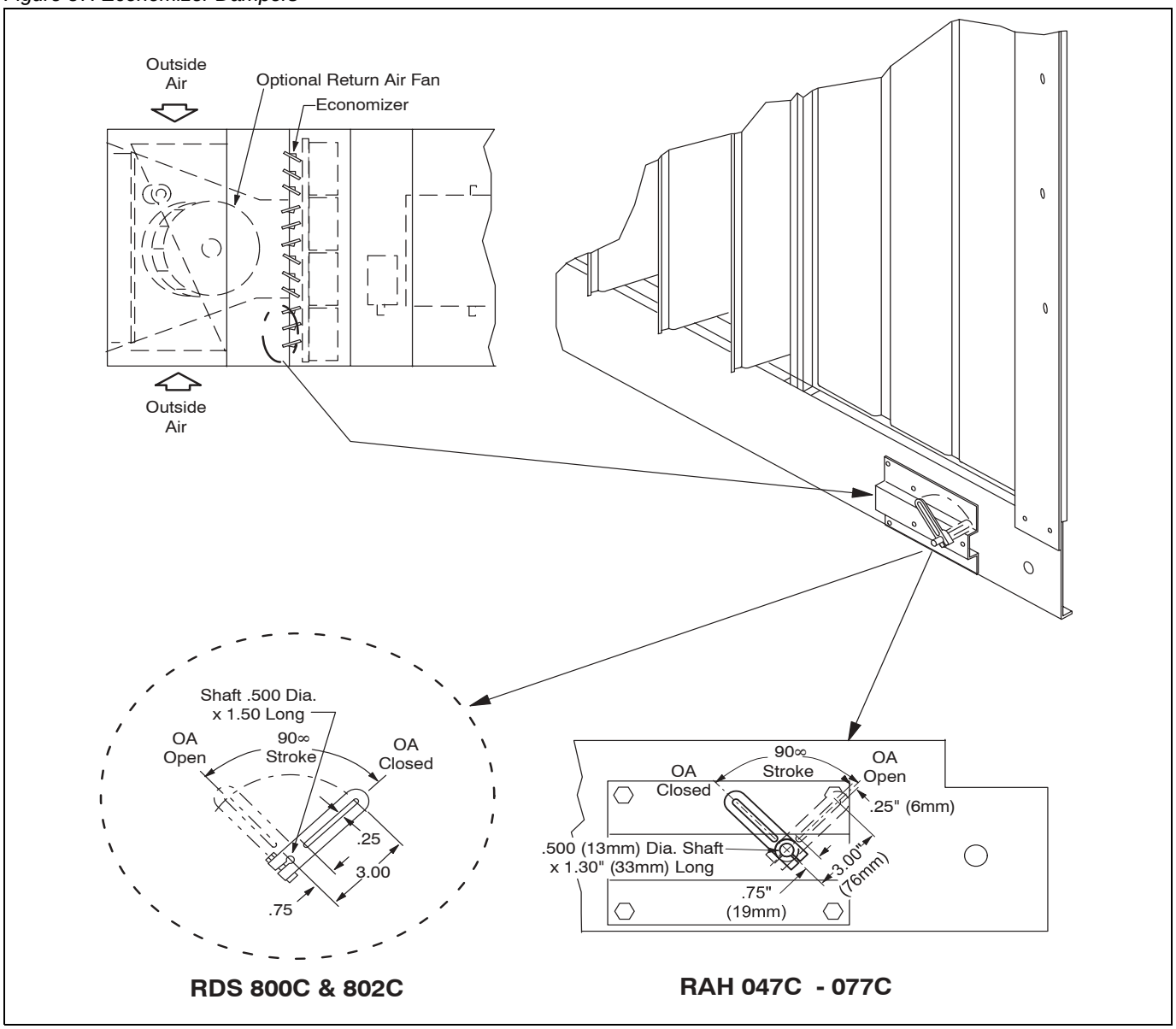
Economizer Dampers

Outside air intake is provided on both sides of the unit, and the return air path is at the center of the damper set. As the single actuator modulates the outside air dampers open, the return air dampers close. Exhaust air exits the unit through the gravity relief dampers provided at the end of the economizer section.

The outside air return air damper assembly (economizer) comes with manually adjustable linkage. This adjustable linkage can also be used for connection of a damper operator.

The damper is set so that the crankarm moves through a 90-degree angle to bring the economizer dampers from full open to full close. Mechanical stops have been placed in the crankarm mounting bracket. Do not remove stops. If crankarm is driven past stops, damage to linkage or damper will result. The unit will ship with a shipping bolt securing the linkage crankarm. Remove shipping bolt before use.

Figure 37. Economizer Dampers

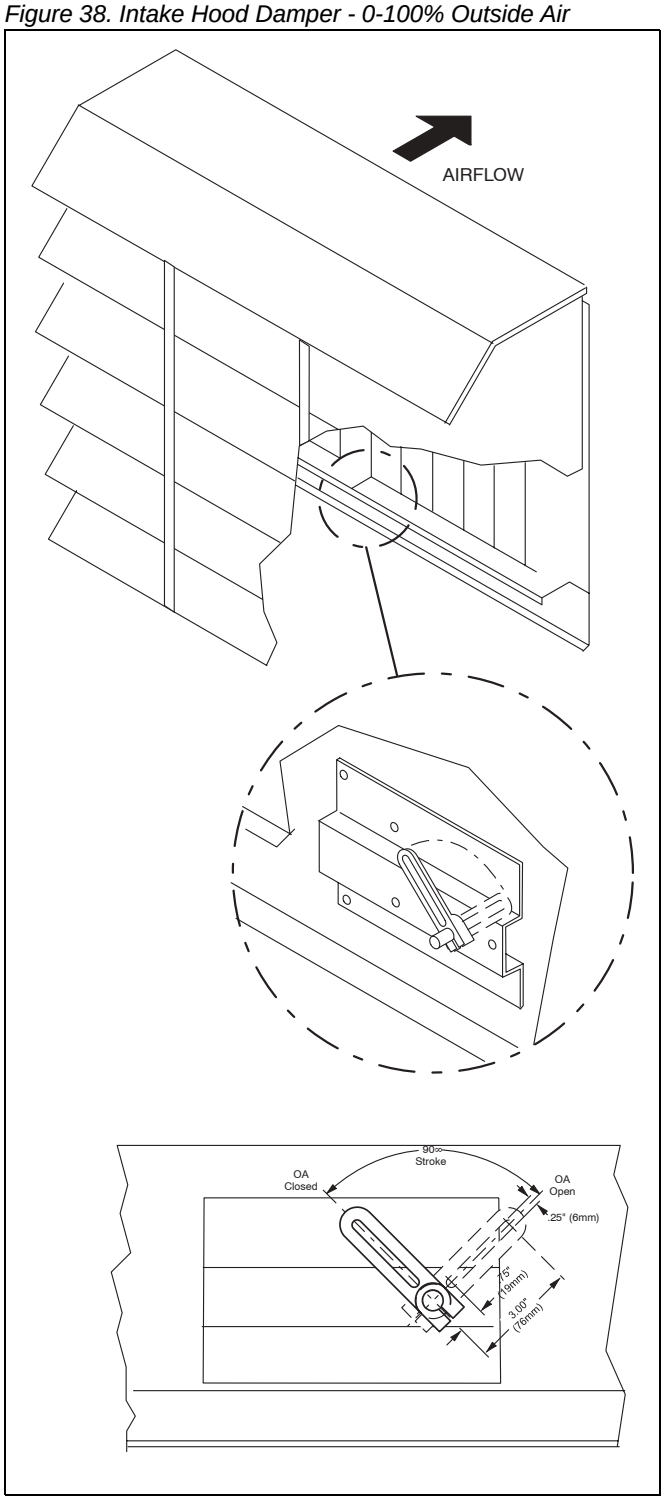


Note: For good airflow control, adjust linkages so damper blades do not open beyond 70 degrees. Opening a damper blade beyond 70 degrees has little effect on its airflow. Do not "overclose " low leak damper blades. The edge seal should just lightly contact the adjoining blade. The blades will lock-up if they are closed so far that the seal goes over center.

Intake Hood Damper
(0 to 100% Outside Air, RAH 47-77 Only)

Units requiring 100% outside air are provided with a rain hood and dampers which may be controlled by a single actuator. The actuator, which may be ordered with factory controls, provides two position control for opening the dampers fully during unit operation and closing the dampers during the off cycle. No unit mounted exhaust dampers are provided.

Figure 38. Intake Hood Damper - 0-100% Outside Air



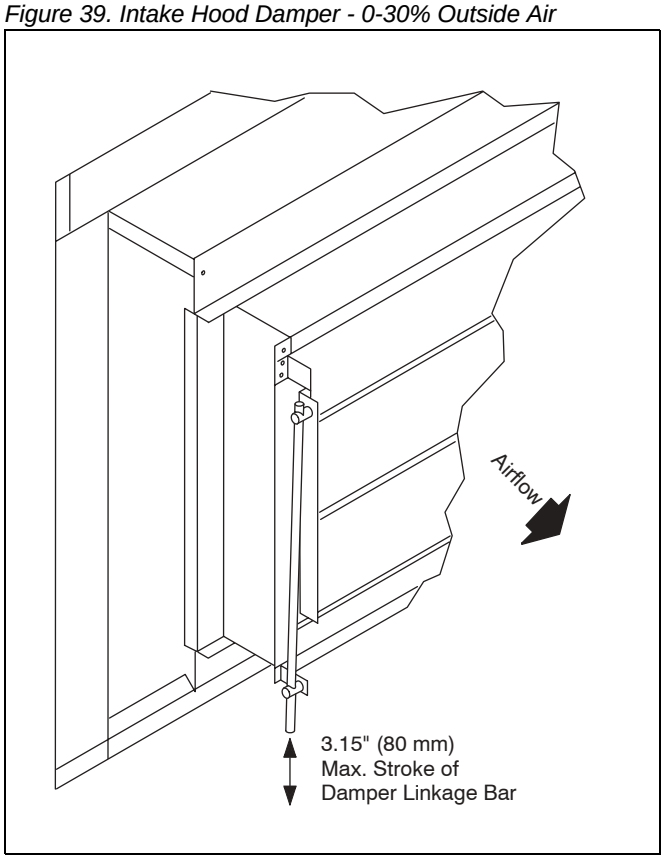
Intake Hood Damper
(0 to 30% Outside Air)

These dampers are intended to remain at a fixed position during unit operation, providing fresh air quantities from 0 to 30% of the total system airflow, depending on the damper setting. This setting is made at the linkage rod on units with manually adjustable linkages.

On units provided with MicroTech™ controls, the damper position may be set at the controller keypad. During unit operation, the two-position actuator drives the damper to the position set on the keypad. During the off cycle, the damper is automatically closed.

No unit mounted exhaust dampers are provided with this option.

Figure 39. Intake Hood Damper - 0-30% Outside Air



Note: 1. *Figure 39* shows the RAH 47-77 (The linkage is on the RH side).

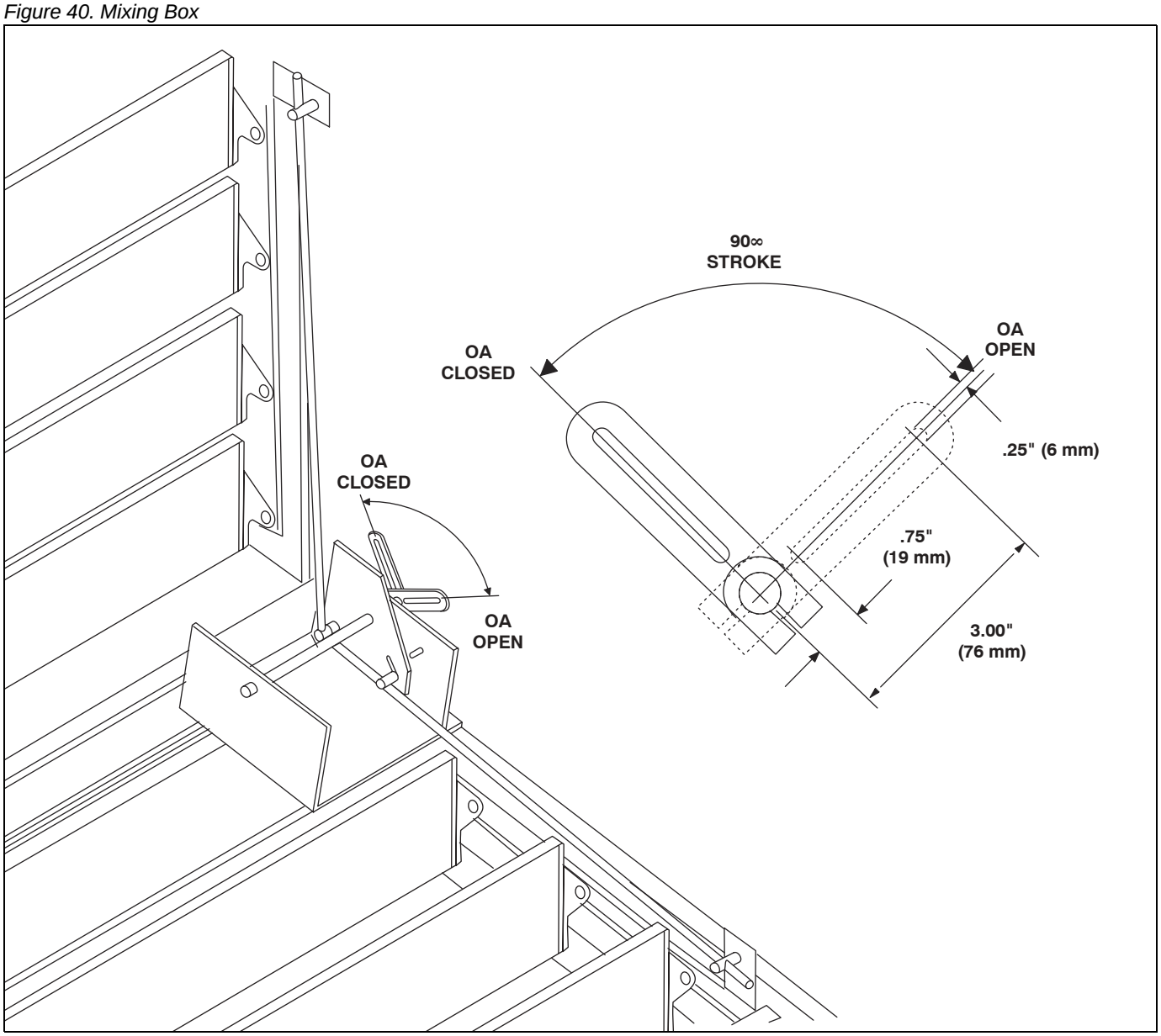
2. The RDS 800-802 are the same except the linkage is on the LH side.

Mixing Box (RAH 47-77 only)

This section utilizes an outside air damper and a return air damper. Use of these dampers allows outside air to be blended with return air. Synchronized operation of the dampers is accomplished by interconnecting rods. As one damper section opens, the other section is being closed. Always a total of 100% CFM is drawn from this section. Damper positioning may be either manually or automatically adjusted. With a field installed controller, automatic operation can be obtained.

These dampers provide a similar function to the economizer dampers. This option differs from an economizer in that no unit mounted exhaust dampers are provided.

Figure 40. Mixing Box



Note: For good airflow control, adjust linkages so damper blades do not open beyond 70 degrees. Opening a damper blade beyond 70 degrees has little effect on its airflow. Do not "overclose " low leak damper blades. The edge seal should just lightly contact the adjoining blade. The blades will lock-up if they are closed so far that the seal goes over center.

Face and Bypass Dampers

Face and bypass dampers are available in a flat arrangement for use with heating coils and standard face area cooling coils, as well as a staggered arrangement for large face area cooling coils. The damper sets are linked through a jack shaft for connection to a single actuator (factory or field installed).

Figure 41. Face and Bypass Dampers - RDS 800-802 only

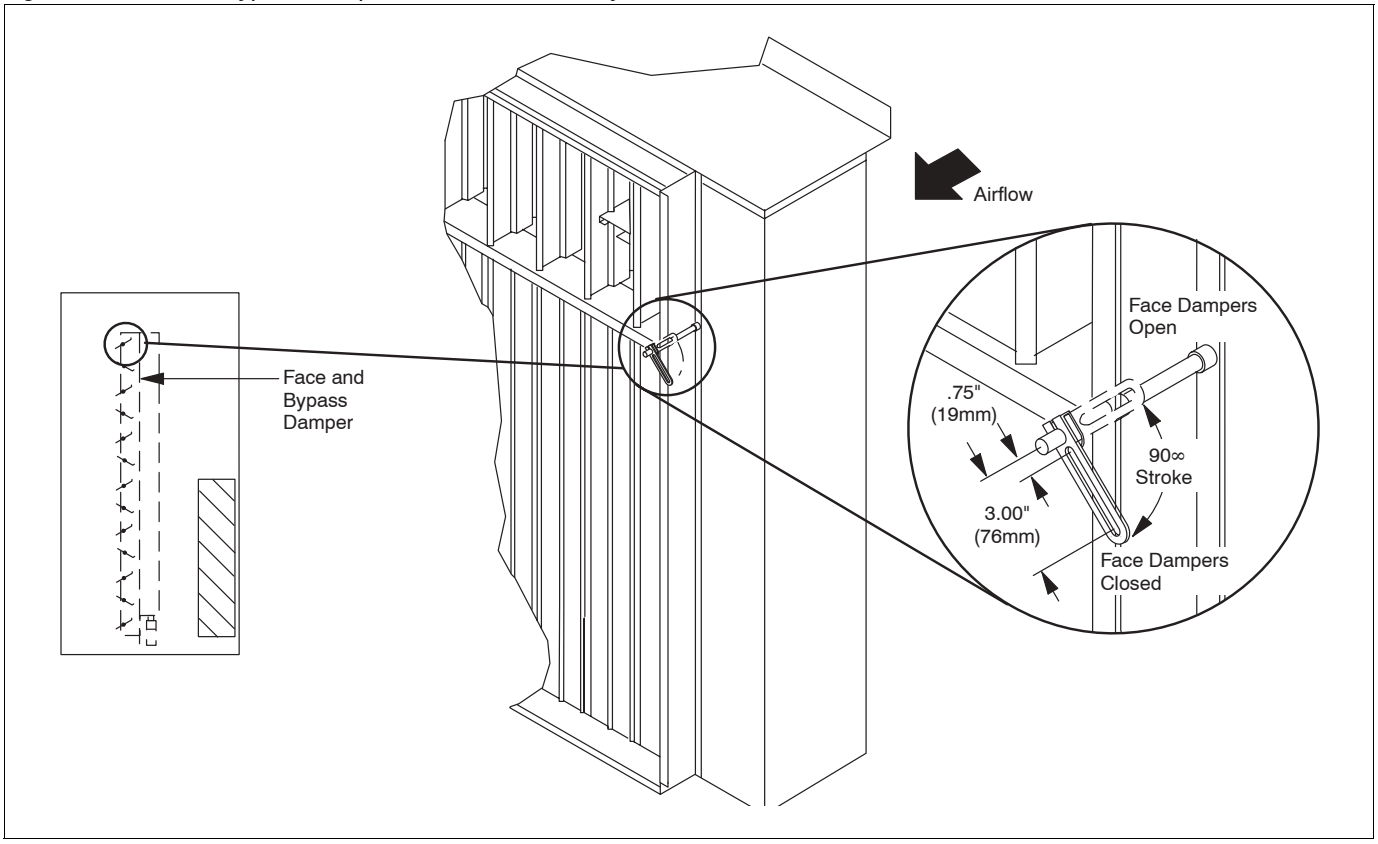


Figure 42. Face and Bypass Dampers - Staggered Arrangement - RAH 47-77 only

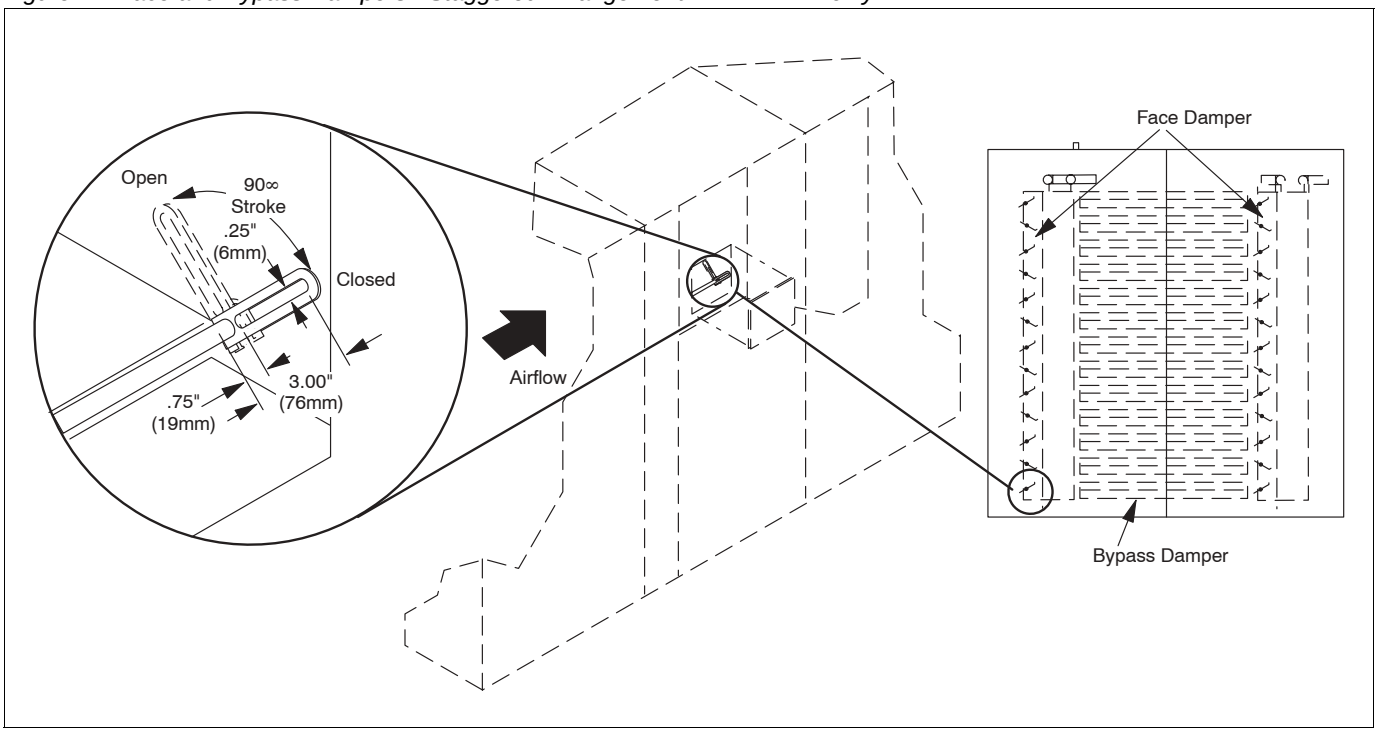
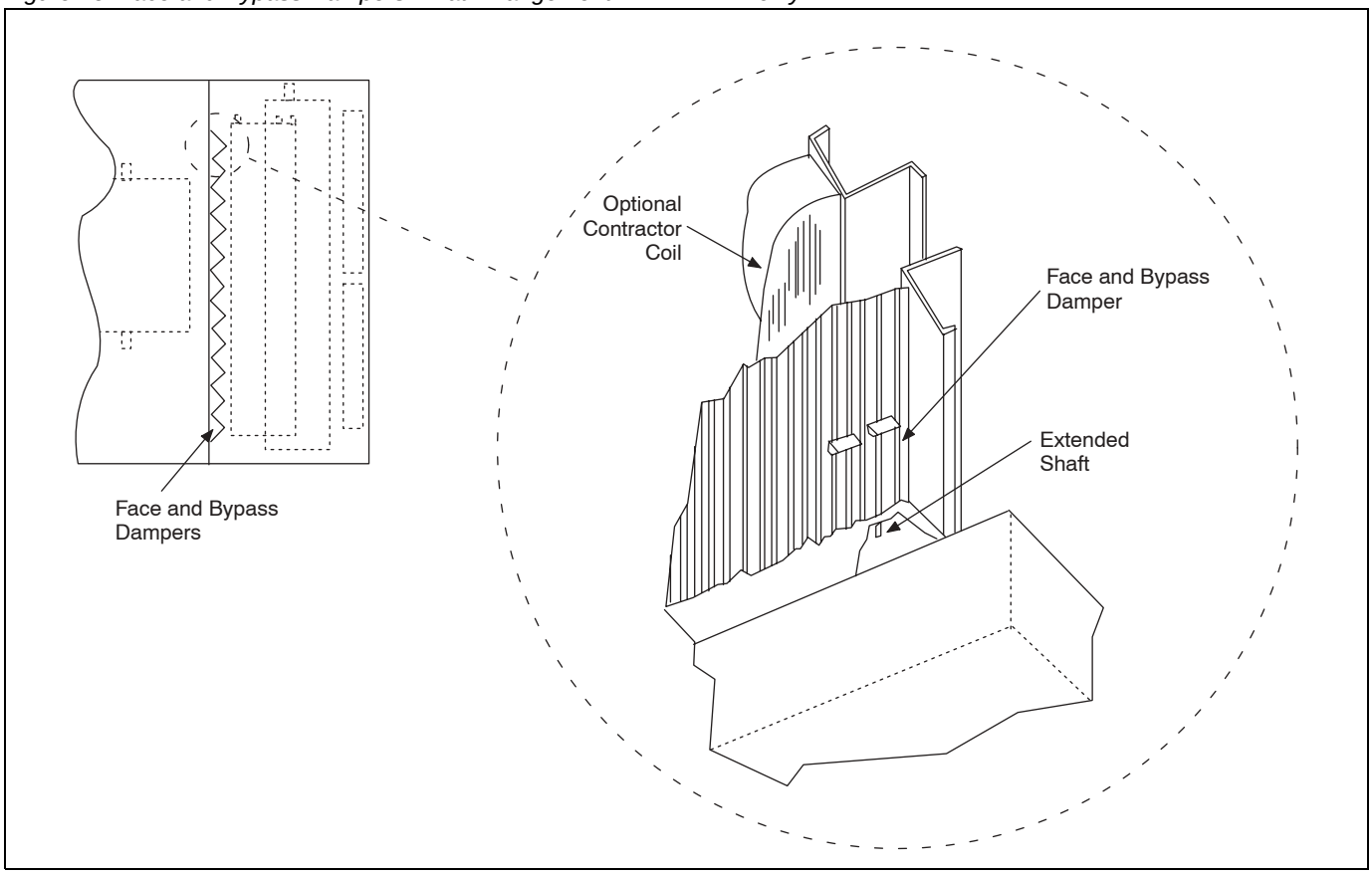


Figure 43. Face and Bypass Dampers - Flat Arrangement - RAH 47-77 only



Cabinet Weatherproofing

This unit ships from the factory with fully gasketed access doors and cabinet caulking to provide weatherproof operation. After the unit has been set in place, inspect all door gaskets for shipping damage and replace if necessary.

It is recommended the unit be protected from overhead water run-off from overhangs or other structures. Re-caulk field assembled options, such as external piping vestibules or split units, per installation instructions provided with the option.

Electrical Installation

Field Power Wiring

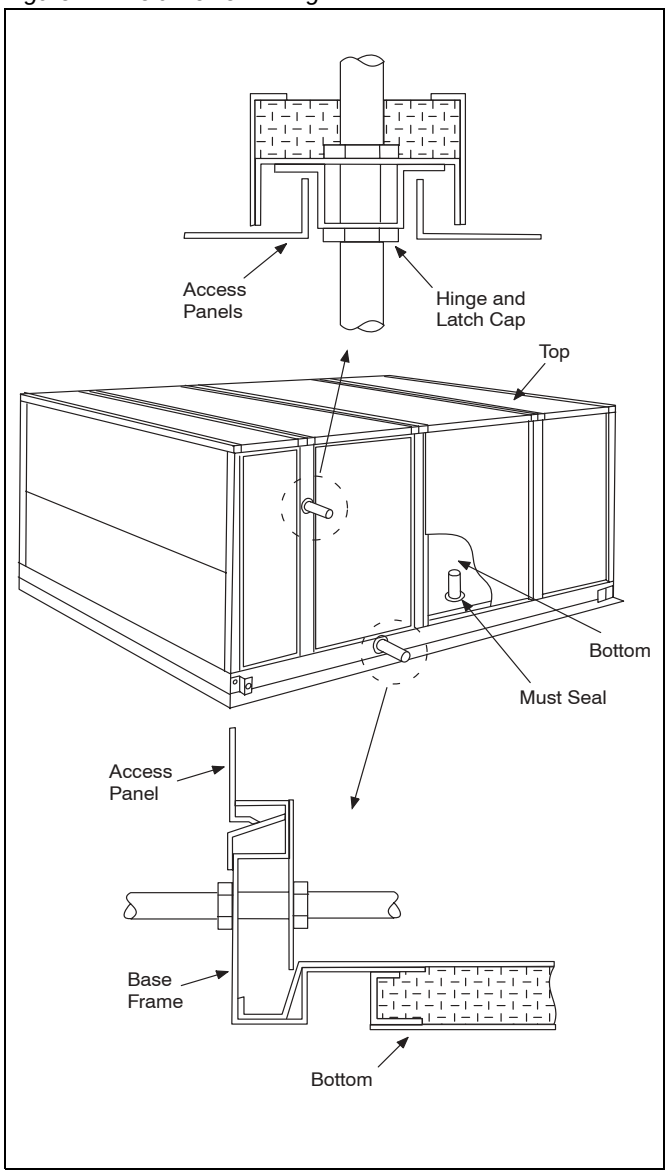
Without Optional Electrical Power Package

All of the unit side panels are hinged. Disconnect switches and/or motor starters must not be mounted on panels which provide access to internal components. Wiring conduits can penetrate the cabinet bottom, base frame or through the hinge and latch cap without interfering with the access panels.

Note: All holes cut into the unit must be sealed to prevent water leakage.

Conduits connecting the unit to external panels will be exposed to relative humidity and air pressure differentials and should be sealed. Ground the motor using copper or other corrosion resistant conductor.

Figure 44. Field Power Wiring



With Optional Electrical Power Package

Wiring must comply with all applicable codes and ordinances. The warranty is voided if wiring is not in accordance with these specifications.

According to the National Electrical Code, a disconnecting means shall be located within sight of and readily accessible from the air conditioning equipment. The unit may be ordered with an optional factory mounted disconnect switch. This switch is not fused. Power leads must be overcurrent protected at the point of distribution. The maximum allowable overcurrent protection is shown on the unit nameplate.

The RAH units may be ordered with internal power wiring for either single or multiple point power connections. If single point power is ordered, a single power block or an optional disconnect switch is located within the main control panel. Field power leads are brought into the unit through 3-inch knockouts in the bottom of the main control panel. *Refer to Figure 45*.

Units ordered with dual point power connections are provided with non-fused, factory mounted disconnect switches. Disconnect DS1 handles the fan load and controls, and is mounted within the main control panel. Disconnect DS3 handles the electrical heat load and is located within the electric heat control panel.

⚠ DANGER

Hazardous voltage.
May cause severe injury or death.

Lock and tag out all electric power before servicing equipment. More than one disconnect may be required to de-energize the unit.
If the unit has a factory mounted disconnect switch, the switch must generally be turned off to open the main control panel door.

The door can be opened without disconnecting power by turning the screw at the bottom of disconnect switch clockwise while pulling the door open. If this is done, however, caution must be used since power is not removed from the unit or the controller.

The minimum circuit ampacity (wire sizing amps) is shown on the unit nameplate. *Refer to Table 11* for recommended number of power wires.

*Table 11: Recommended 3-phase power wiring**

FOR MCA Up to (Amps)	Wire Gauge	Qty./ Pole	Insulation rating (°C)	No. of Conduits	Conduit/ (Trade, Size, In.)
30	10	1	60	1	1/2
40	8	1	60	1	3/4
55	6	1	60	1	1
70	4	1	60	1	1-1/4
85	3	1	60	1	1-1/4
95	2	1	60	1	1-1/4
130	1	1	75	1	1-1/4
150	1/0	1	75	1	1-1/2
175	2/0	1	75	1	2
200	3/0	1	75	1	2
230	4/0	1	75	1	2
255	250	1	75	1	2-1/2
285	300	1	75	1	2-1/2
310	350	1	75	1	3
335	400	1	75	1	3
380	500	1	75	1	3
400	3/0	2	75	2	2
460	4/0	2	75	2	2
510	250	2	75	2	2-1/2
570	300	2	75	2	2-1/2
620	350	2	75	2	3
670	400	2	75	2	3
760	500	2	75	2	3
765	250	3	75	3	2-1/2
855	300	3	75	3	2-1/2
930	350	3	75	3	3

*To provide that disconnects and power blocks mate with power wiring

Notes:

1. All wire sizes assume separate conduit for each set of parallel conductors.
2. All wire sizes based on NEC Table 310-16 for THW wire (copper). Canadian electrical code wire ampacities may vary.
3. All wire sizes assume no voltage drop for short power leads.
   *To provide that disconnects and power blocks mate with power wiring.

Copper wire is required for all power lead terminations at the unit. Size wires in accordance with the ampacity tables in Article 310 of the National Electrical Code. If long wires are required, it may be necessary to increase the wire size to prevent excessive voltage drop. Size wires for a maximum of 3% voltage drop. Supply voltage must not vary by more than 10% of nameplate. Phase voltage imbalance must not exceed 2%. (Calculate the average voltage of the three legs. The leg with voltage deviating the farthest from the average value must not be more than 2% away.) Contact local power company for correction of improper voltage or phase imbalance.

⚠ CAUTION

Improper line voltage or excessive phase imbalance constItutes product abuse. May cause severe damage to the unit electrical components.

Assure proper line voltage and phase balance.

A ground lug is provided in the control panel for each power conduit. Size grounding conductor in accordance with Table 250-95 of the National Electrical Code.

In compliance with the National Electrical Code, an electri-Cally isolated 115V circuit is provided in the unit to supply the factory mounted service receptacle outlet and optional unit lights. This circuit is powered by a field connected 15A 115V power supply. Leads are brought into the RAH unit through a 7/8" knockout in the bottom of the main control panel, near the power wire entry point.

⚠ WARNING

Electrical shock hazard.
May cause severe injury or death.

All protective deadfront panels must be reinstalled and secured when power wiring is complete.

Figure 45. Power Wiring Entrance

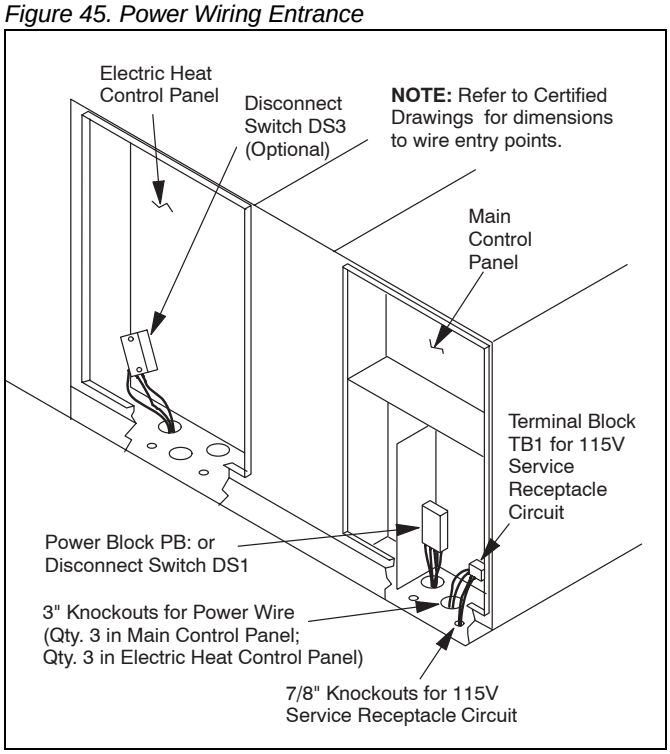
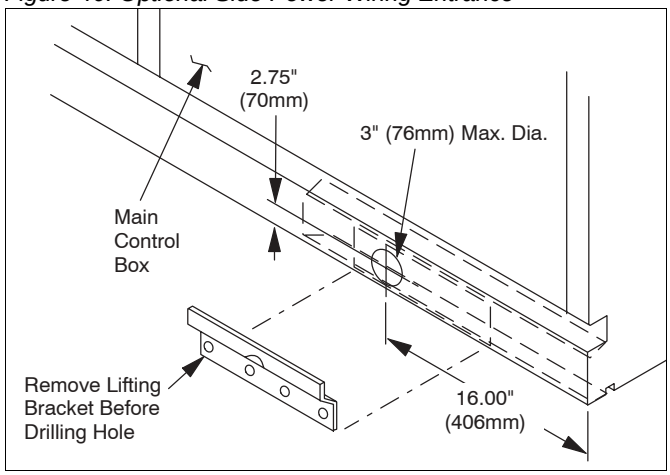

Electric Heat Control Panel
Disconnect Switch DS3 (Optional)
NOTE: Refer to Certified Drawings for dimensions to wire entry points.
Main Control Panel
Terminal Block TB1 for 115V Service Receptacle Circuit
Power Block PB: or Disconnect Switch DS1
3" Knockouts for Power Wire (Qty. 3 in Main Control Panel; Qty. 3 in Electric Heat Control Panel)
7/8" Knockouts for 115V Service Receptacle Circuit

Figure 46. Optional Side Power Wiring Entrance



The preferred entrance for power cables is through the bottom knockouts provided on the unit. If side entrance is the only option, a drilling location is provided. The drilling dimensions must be followed exactly to prevent damage to the control panel. The dimensions provided are the only possible point of side entrance for the power cables.

Field Control Wiring

⚠ CAUTION

Wiring must comply with applicable codes and ordinances and these specifications.

Defects caused by incorrect wiring are not covered by the warranty.

Connect the control wiring as shown on the wiring diagrams provided with the unit. Units are available with a number of optional control arrangements. Specific field wiring connections for these arrangements are described in *IM-696 and OM 137 or OM 138.*

If unit mounted control devices are to be installed in the field, control wiring may be run from the device to the main control box using the control wiring raceway shown in *Figure 47*. Connect field wired harnesses to terminal blocks TB2. TB5. TB7, TB8 or TB10 as indicated on the unit schematics. The field control wiring terminal block TB2 is located in the main control panel. *Refer to Figure 47*.

Two 7/8" knockouts are provided for wire entry.

⚠ WARNING

Electrical shock hazard.
Can cause severe injury or death.

Connect terminal strip TS2 to 24V Class II circuits only. Do not connect these contacts to a field supplied 115V power source.

Reinstall and secure all protective deadfront panels when the wiring installation is complete.

Interconnecting wiring between the rooftop air handler unit and a remote condensing unit or chiller enters the rooftop air handler unit through 7/8" knockouts in the bottom of the main control panel. The 115V wiring is connected to TB5. *Refer to "Typical Control Circuit with Power Pack Only" on page 50*. The TBS output relays must switch "AC" loads. The load voltage rating must be within the range 24 to 140 VAC. The maximum load current is 1.8A and the minimum load current is 30mA. The 24V wiring is connected to terminal block TB7 which is illustrated in *"Typical Main Control Circuit (VAV Units)" on page 52*.

A 7/8" knockout is also available in the end of the unit base as shown *in Figure 48*. Note: If a single conduit containing 24V and 115V wiring is run above the roofline, the 24V wiring must be installed as an NEC Class I wiring system.

Figure 47. RAH Field Control Wiring Connections

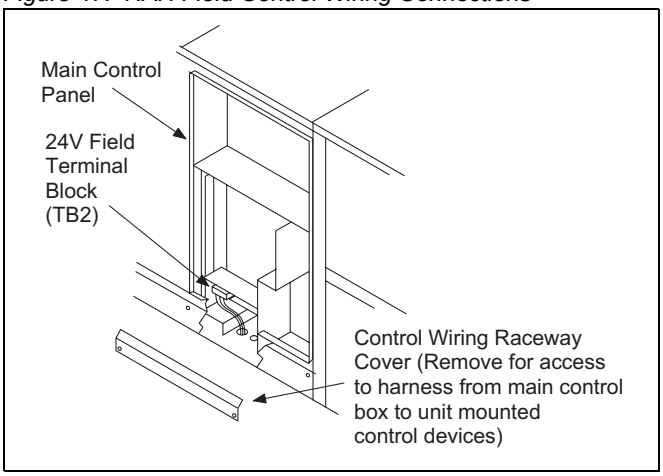
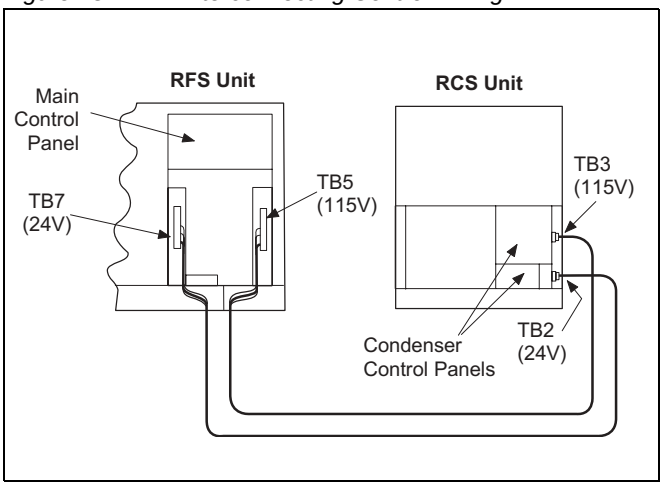

Main Control Panel
24V Field Terminal Block (TB2)
Control Wiring Raceway Cover (Remove for access to harness from main control box to unit mounted control devices)

Figure 48. RAH Interconnecting Control Wiring



Preparing Unit for Operation

⚠ WARNING

Moving machinery hazard.
Can cause severe injury or death.

Lock out and tag out all power and lock off before servicing equipment. More than one disconnect may be required to de-energize unit.

Relief Damper Tie-Down

(RDS 800-802 units only)

Economizer sections with a 30" or 40" return fan have a relief damper that is tied down for shipping. Two brackets and two screws must be removed before operation to allow free movement of dampers. Access is from inside the economizer section.

Spring Isolated Fans

Release of Spring Mounts

Spring-mounted supply and return fans are locked down for shipment.

Return Fans

Hold-down fasteners are located at each spring mount. These fasteners must be removed before operating the fans.

The front mounts on RDS 800-802 return fans are accessible by removing a 3" OD closure plug in the louvered fresh air intake. Replace the plug after removing the lock-down bolts.

If it is necessary to change or replace the forward (front) isolators on the RDS 800 or 802 return fan, proceed as follows:

1. Open fresh air intake louver door and remove the triangular shaped floor pan (remove sheet metal screws).
2. Forward spring mount is now visible and can be replaced.
3. Caulk all edges of the floor pan before reinstalling to prevent leaks.

Supply Fans

Hold-down fasteners are located at each of the two spring mounts on the inlet side of the fan base. A third hold down fastener is located on the fan base directly below the bearing on the wheel side of the fan assembly. *Refer to Figure 49*.

Figure 49. Supply Fan Assembly

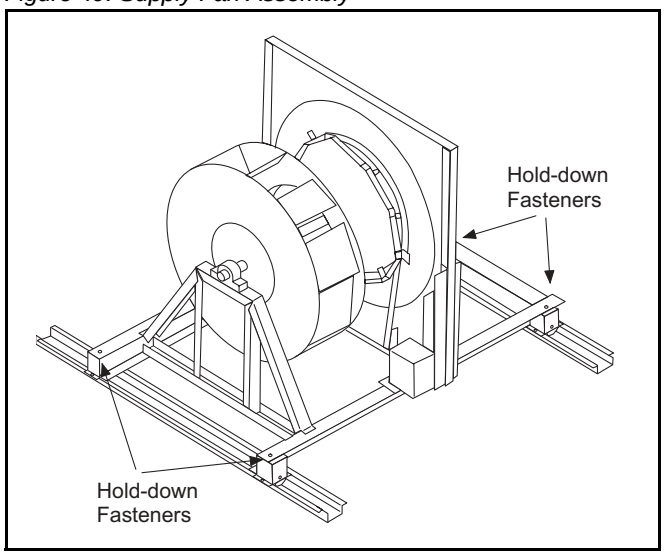
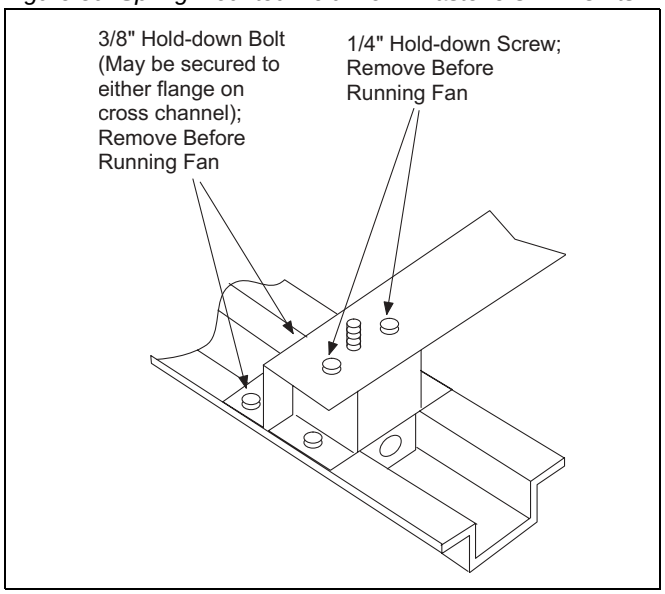


Figure 50 shows a typical spring mount. Note that the 3/8" hold-down bolt securing the fan base to the unit cross channel must be removed, as well as all 1/4"screws directly above the spring mount.

In some unit arrangements, one of the 3/8" hold-down bolts lies below the motor base. The bolt can be reached with a 9/16" socket and **must be removed.**

After removing the hold-down fasteners, rock by hand the fan assembly to check for freedom of movement.

Figure 50. Spring Mounted Hold-Down Fasteners - All Units

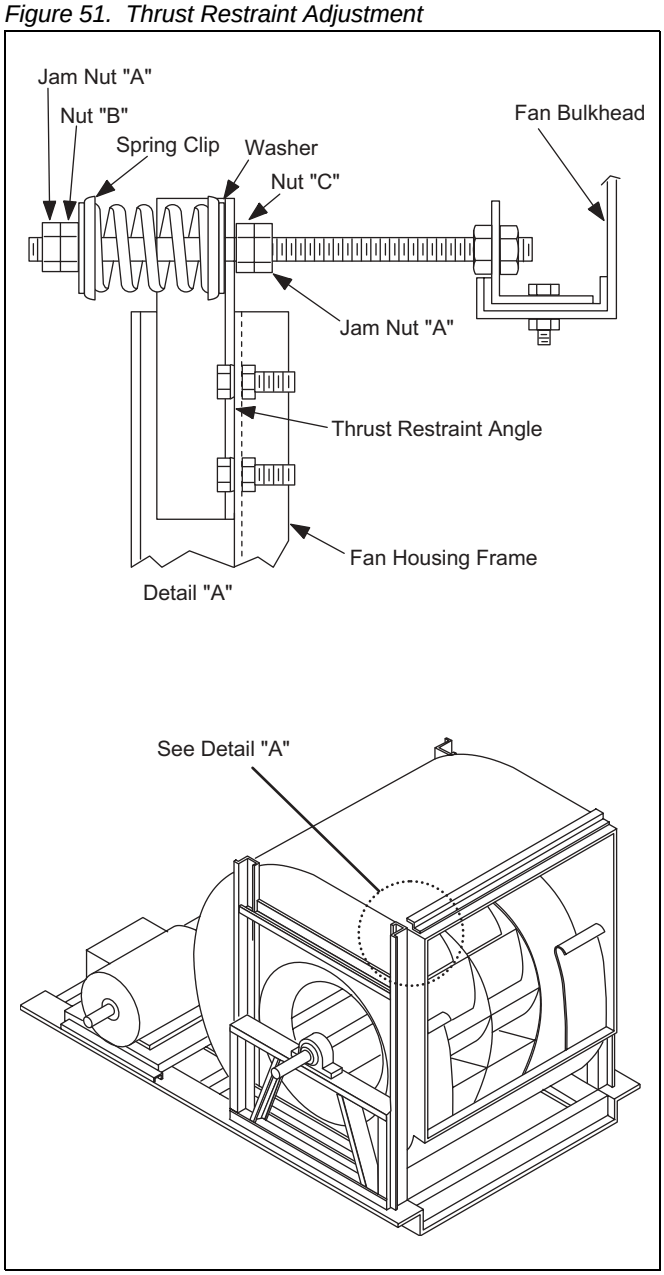


Adjustment of Supply Fan Thrust Restraints

Thrust restraints are provided when housed double-width fans are mounted on springs. After the spring mounts have been adjusted for level operation when the fan is running, check the thrust restraints. With the fan off, set the adjustment nuts so the spring is slightly compressed against the angle bolted to the fan housing frame. When the fan is turned on, the fan will move back to a level position and the thrust restraint springs will compress. *Refer to Figure 51 on page 44.*

1. With the fan off, loosen Jam Nuts "A".
2. Turn Nut "C" until the spring cup and washer contact thrust restraint angle.
3. Turn Nut "B" until spring is compressed by two turns of Nut "B".
4. Tighten Jam Nuts "A".

Figure 51. Thrust Restraint Adjustment



Adjustment of Spring Mounts

During operation, all fans should ride level, with the bottom of the fan base approximately 3/8" (10mm) above the top of the unit's cross channel. Unhoused single-width "plug" fans will also ride at this level when at rest.

When not operating, housed double-width fans will ride lower at the discharge end of the fan base than at the motor end. When the fan is operating against a static pressure, it should run level. If not, level the assembly as follows: *(refer to Figure 52)*

1. Loosen the 15/16" jam nut above the fan base.
2. Using a large, straight blade screwdriver, turn the 5/8" leveling screw clockwise to lower the fan base, counter-clockwise to raise the fan base.
3. When properly adjusted, retighten the jam nut.

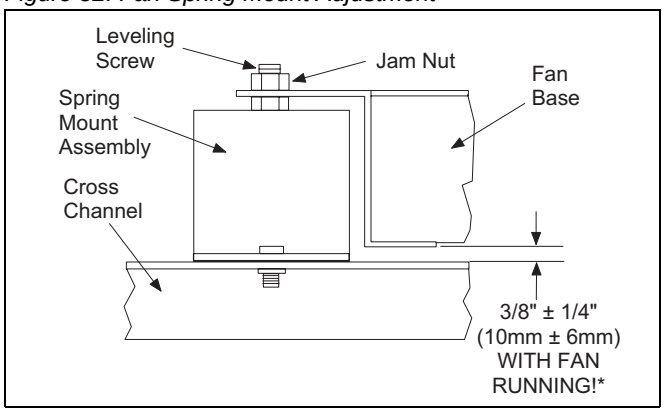
.

⚠ DANGER

Moving machinery hazard.
Can cause severe injury or death.

Lock out and tag out all power before working on the fans.

Figure 52. Fan Spring Mount Adjustment



* This (10mm) can be affected by thrust restraints that are grossly out of adjustment. This dimension must be rechecked after thrust restraints are adjusted.

Adjustment of Seismic Restraints

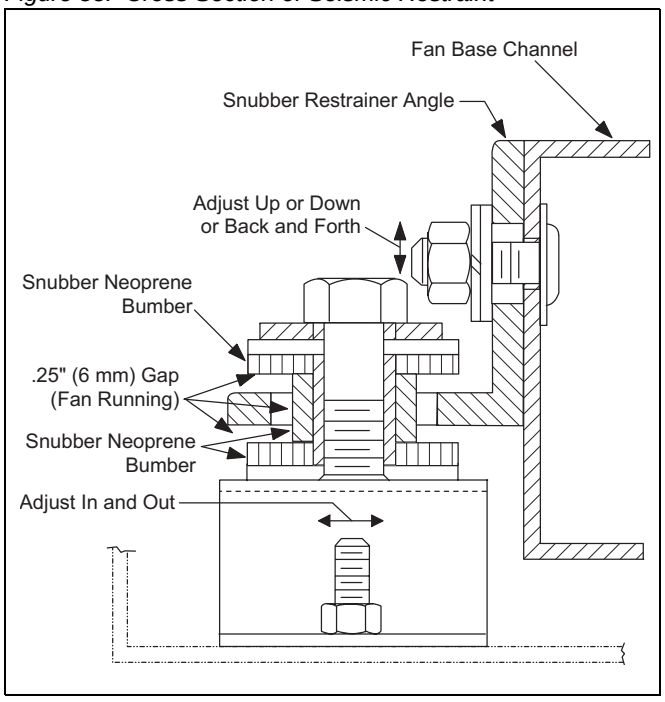
Spring mounted supply air and return air fans may be ordered with factory installed seismic restraints. The system consists of four snubbers, one located next to each spring isolator. These snubbers will allow free movement of the fan assemblies during normal operation because normal operation will not cause fan movements that exceed .25" (6 mm). However, they will restrain the fan assembly and limit movement to .25" (6 mm) in any direction if an abnormal condition were to occur.

The position the fan will assume during normal operation will be determined by actual job site airflow and static pressure. Therefore, for proper operation, the seismic restraints must be field adjusted as part of the normal "Check, Test and Start" procedure. When the fan is operating in a normal manner there should be no contact between the snubber restrainer

angle and the snubber neoprene bumper. However, in a "seismic event," the snubber will limit movement of the spring mounted fan assembly to .25" (6 mm) in any direction, thereby helping to prevent the fan from being tossed about and damaged, or causing damage.

When a seismic restraint is properly adjusted and the fan is operating normally, the neoprene center bumper will be centered within the 2" (51 mm) diameter hole in the restrainer angle, and the restrainer angle will be centered vertically between the flanges of the neoprene center bumper. This results in .25" (6 mm) clearance in all directions. When the fan is turned off the restrainer angle may come to rest on the neoprene center bumper.

Figure 53. Cross Section of Seismic Restraint



The seismic restraint is adjustable in all directions. Vertical slots in the restrainer angle and horizontal slots in the blower base allow the restrainer angle to be adjusted up and down and back and forth. The neoprene center bumper is mounted on a slotted hole allowing its adjustment in and out.

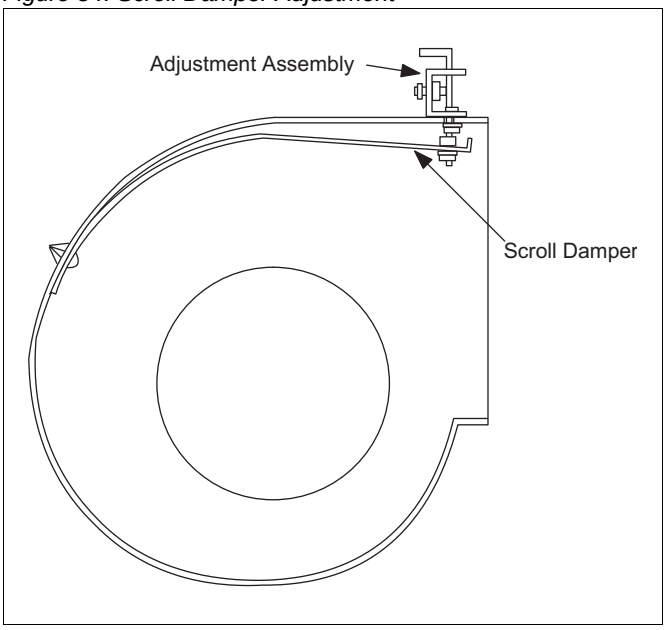
Removing the neoprene center bumper bolt allows removal, disassembly, and replacement of the neoprene components.

Adjustment of Scroll Dampers

(RDS 800 Only)

Two sets of scroll dampers are provided in the housing of the twin 15" x 6" supply fan to allow control of air volume to each fan wheel. At the factory, these dampers are fully closed unrestricting airflow. If fan paralleling occurs, correction can be made by loosening the adjustment screws on top of the fan housing and slightly lowering the rod until air distribution between the fans is even. *See Figure 54.*

Figure 54. Scroll Damper Adjustment



Sequences of Operation

The following sequences of operation are for a typical "C" vintage applied rooftop unit that is equipped with MicroTech II, an economizer, 4 compressor / 8 stage cooling, 3 to 1 turn down burner, variable frequency drives (VFD), a return air fan and an external time clock. These sequences describe the ladder wiring diagram logic in detail; refer to *"Wiring Diagrams" on page 48* as you read them. Note that your unit's sequences of operation may vary from those described here. Refer to the wiring diagrams supplied with the unit for exact information.

For detailed description of operation information relating to the MicroTech II controller's software, refer to the appropriate operation manual (see *Table 1 on page 3*). These manuals describe the various setpoints, parameters, operating states, and control algorithms that affect rooftop unit operation.

Power-up

When primary power is connected to the unit, 115VAC power is fed through control circuit transformer TI and control circuit fuse FI (line 200) to compressor crankcase heaters HTR-1, HTR-2, HTR-3 and HTR-4 (lines 825, 875, 823 and 873).

When system switch S1 (line 205) is closed, low voltage transformers T2 (line 205), T3 (line 300)and T9 (line 805) are energized, and 115VAC power is supplied to the following:

- Smoke detectors (line 284)
- Economizer actuator ACT3 (line 336)
- Supply fan vane actuator ACT1 (line 340) or
- M30A to energize the supply fan VFD (line 311)
- Return fan vane actuator ACT2 (line 346) or
- M40A to energize the return fan VFD (line 316)
- Heating control panel
- Compressor circuit switches CSI and CS2 (lines 828 and 878)

Transformer T2 supplies 24VAC power to terminals 24V & 24C on the main control board MCB (lines 207 and 208). By way of terminal TB6-48 (lines 206), transformer T2 supplies 24VAC power to the following:

- Switch S7 On-Auto-Off (line 223)
- Enthalpy sensor OAE (line 265)
- External time clock contacts (line 222)
- External exhaust fan status contacts (line 273, VAV only)
- Airflow interlock switch PC7 (line 248)
- Dirty filter switches PC5 and PC6 (lines 256 and 260)
- Duct high limit switch DHL (line 276, DTC only)
- Gas furnace alarm relay R24 (line 244)
- Freezestat switch FS1 (line 251, hot water or steam heat only)
- Smoke detectors SDI and SD2 (line 254)

When the field supplied Cool Enable switch is in the "off" position, field wiring terminal 105 is de-energized (line 233). Binary input MCB-BI3 will be de-energized and the cooling will be disabled. When the field supplied Heat Enable switch is in the "off" position, field wiring terminal 106 is de-energized (line 242). Binary input MCB-BI4 will be de-energized and the heating will be disabled. Note: Unit ships with factory installed jumpers between 101 and 105 and between 101 and 106.

Fan Operation

When the supply and return fans are commanded to start by the Microprocessor Control Board (MCB), the unit enters the Startup Initial operating state. As a result, a 3-minute timer is set, output MCB-BO3 (line 394) energizes and relay R26 energizes (line 393). On VAV units with inlet vanes, outputs MCB-BO14 and MCB-BO16 energize (lines 344, 342), causing the supply and return fan inlet vanes to open. When the vanes open to their minimum positions, MCB-BO14 and MCB-BO16 are de-energized, causing the inlet vanes to hold.

After the 3-minute timer expires, the unit enters the Recirculate operating state. As a result, output MCB-BO1 energizes relay R67 (line 304). This gives a start signal to supply fan drive AFD10 (line 343). Four seconds after MCB-BO1 is energized, output MCB-BO2 energizes relay R68 (line 305). This gives a start signal to return fan drive AFD20 (line 343). Overload relays OL9, OL10, OL19, and OL20 (line 311) protect the fans from excessive current draw. If either the supply or return fan is drawing excessive current, one of the relays will open its contacts and cause both fans to stop.

Within 120 seconds after the fans start, the controller expects airflow switch PC7 (line 248) to close and thus energize binary input MCB-BI6. (If MCB-BI6 does not energize, the controller will assume the fans did not start. It will then shut down the unit and generate an alarm.)

During the Recirculate operating state, the outside air damper is held closed. The controller does this by energizing output MCB-BO5 (line 338). On VAV units, output MCB-BO12, the VAV box output, is also de-energized (line 395) during the Recirculate state.

On VAV units, the supply fan adjustable frequency drive (AFD10) or inlet vanes (ACT1) are modulated to maintain the duct static pressure setpoint. When energized, output MCB-BO14 drives AFD10/ACT1 towards increased capacity, and MCB-BO13 drives them towards decreased capacity (line 344). On VAV units or CAV units equipped with return fan capacity control, the adjustable frequency drive (AFD20) or the return fan vanes (ACT2) are modulated to maintain an acceptable building static pressure (using either VaneTrol logic or direct measurement of building pressure: see the appropriate OM for more information). When energized, output MCB-BO16 drives AFD20/ACT2 towards increased capacity, and MCB-BO15 drives them towards decreased capacity (line 342).

Economizer Operation

When the outdoor air is suitable for free cooling, the switch in enthalpy sensor OAE is in position "3" (line 267) energizing binary input MCB-BI11. When MCB-BI11is energized, the economizer is enabled. (Note: If selected from the keypad, the enthalpy decision can be made based on outdoor temperature. In that condition, if the outdoor air temperature is less than or equal to the changeover setpoint, the economizer is enabled.) If cooling is required, the economizer dampers (ACT3) are modulated to maintain the discharge air temperature setpoint. When energized, output MCB-BO6

drives the outdoor air dampers towards the open position, and MCB-BO5 towards the closed (line 338). If the outdoor air dampers are wide open and more cooling is required, the dampers will hold their positions and mechanical cooling will be activated (see below).

When the outdoor air is not suitable for free cooling, the switch in enthalpy sensor OAE is in position "1", de-energizing binary input MCB-BI11 (Alternatively, the outdoor air temperature is above the changeover setpoint plus the economizer changeover differential). When the economizer is disabled, the dampers are held at their minimum position.

Heating

Gas Furnace, Modulating Burner (3 to 1 turn down)

Refer to "Typical Gas Furnace Control Circuit (Modulating Burner, Mixed Air Intake)" on page 58 as you read this sequence of operation. Note that the gas furnace wiring diagrams supplied with the units include a detailed sequence of operation. Refer to the wiring diagram supplied with the unit for exact wiring and sequence of operation information.

When system switch S1 is closed, 115 VAC power is supplied to the furnace control circuit. If burner switch S3 and safeties HL22, HL23 are closed, terminal 5 (line 615) on the flame safeguard control (FSG) will be energized as will the modulating gas valve VM1. If heating is enabled (MCB-BI4 is energized) and heating is required, the MCB-BO11 will energize (line 605), thus energizing relay R20. The normally open R20 contacts (line 610) close, and if manual burner switch S3 and safeties HL22, HL23, FLC (high limit switch), LP5, and HP5 are closed, terminal 6 (line 631) on the flame safeguard control (FSG) will be energized. FSG will energize terminal 4 to start the blower motor (BM) through contactor M29 (line 615). If the blower is operational, air switch AS (line 633) will close and make FSG terminal 6 to 7. After a 90-second prepurge period, FSG terminals 8 (line 621) and 10 (line 630) are energized. As a result, ignition transformer IT and pilot gas valve GVI are energized. The pilot flame will ignite and be detected by FSG through flame rod FD (line 622). Upon detection of pilot flame after the 10 second trial for ignition period, the FSG will de-energize terminal 10 and energize terminal 9 to energize main gas valves GV2 and GV3 (lines 625, 626) and low fire start relay R23 (line 628). The R23 contacts (lines 642 and 643) allow the MCB to modulate gas valve actuator VM1 as required to satisfy the heating demand.

Whenever the burner is operating, its firing rate will be determined by the position of gas valve actuator VM1. This actuator modulates the butterfly gas valve and combustion air damper (lines 690 and 692), thus varying the furnace firing rate between 33% and 100% of full capacity. When the MCB-BO10 energizes (line 645), VM1 modulates toward open and the firing rate increases. When MCB-BO9 energizes (line 644), VM1 modulates toward closed and the firing rate decreases. When both MCB-BO10 and MCB-BO9 are open, VM1 holds its position and the firing rate remains constant.

When heating is no longer necessary, MCB-BO11 opens, de-energizing relay R20 and opening its contacts in line 610. As a result, the flame safeguard control is de-energized, all gas valves close, the combustion air blower motor stops, and gas valve actuator VM1 closes. If the furnace is warm enough to close it, the FLC fan controls switch (line 609) will override supply fan start/stop output MCB-BO1 through R67 (line 607) and keep the supply fan running until the furnace cools down (this might happen during night setback operation).

If the furnace overheats, the FLC high limit control (line 610) will cycle the burner, preventing the furnace temperature from exceeding the limit control's set point. When the furnace is cycled off, low fire start relay R23 de-energizes. The normally closed R23 contacts (line 643) cause VM1 to drive to its minimum position, overriding MicroTech II control of VM1 via MCB-BO10 and MCB-BO9. Because relay R23 is de-energized whenever GV2 is de-energized, the burner will always start at low fire.

Flame Control Lockout

If the pilot flame does not ignite or the flame safeguard fails to detect its flame within 10 seconds, the flame safeguard control will enter the "lockout" state. FSG terminals 4, 8,9 and 10 will be de-energized and the burner will be shut down. FSG terminal 3 will energize relay R24 (line 633). The R24 contacts (line 244) signal the controller that the problem exists by energizing the input to MCB-BI5. If a lockout occurs, the flame safeguard control must be manually reset.

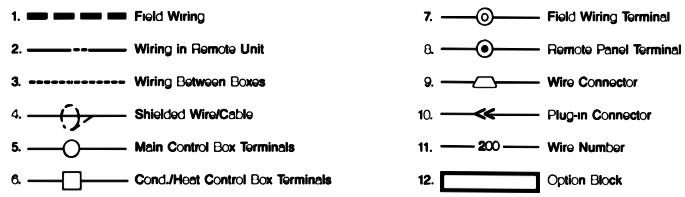
Wiring Diagrams

Legend

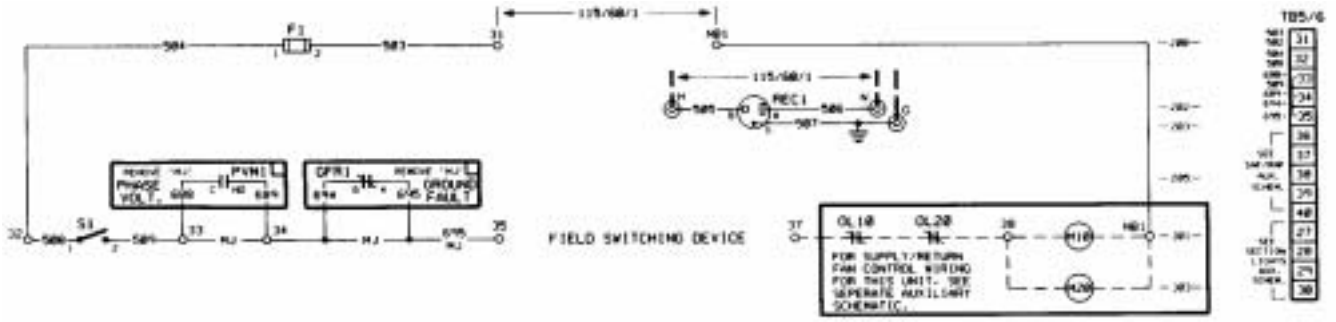
Designation	Description	Std. Location
ACT1	Actuator Motor, Supply Fan Vanes	Supply Air Sect.
ACT2	Actuator Motor, Return Fan Vanes	Return Air Sect.
ACT3, 4	Actuator Motors, Economizer Dampers	Economizer Sect.
ACT5	Actuator Motor, Discharge Isolation Damper	Discharge Sect.
ACT6	Actuator Motor, Return Air Isolation Damper	Return Air Sect.
ACT 10, 11	Actuator Motors, Exhaust Dampers	Return Air Sect.
ADI	ADI Board	Main Control Box
AS	Blower Air Switch	Furnace Sect.
BM	Burner Blower Motor	Furnace Sect.
Cl, 5	Power Factor Capacitors. Compressor #1	Condenser Sect.
C2, 6	Power Factor Capacitors, Compressor #2	Condenser Sect.
C9, 10	Power Factor Capacitors, Supply Fan	Supply Air Sect.
C11	Capacitor, Speed Trol (Circuit #1)	Cond. Bulkhead
C19. 20	Power Factor Capacitors, Return Fan	Return Air Fan
C21	Capacitor, SpeedTrol (Circuit #2)	Cond. Bulkhead
COMPR.#1, 2	Compressors 1 & 2	Condenser Sect.
CS1, 2	Control Switches, Refrigerant Circuits	Cond. Control Box
DHL	Duct High Limit	Main Control Box
DS1	Disconnect, Total Unit or Condenser/Heat	Main Control Box
DS2	Disconnect, SAF/RAF/Controls	Main Control Box
DS3	Disconnect, Electric Heat	Electric Heat Sect.
DS4	Disconnect, Condenser	Cond. Control Box
Fl	Fuse, Control Circuit	Main Control Box
F2	Fuse, Control Circuit	Cond. Control Box
F3	Fuse, Burner Motor	Main Control Box
FBi, 2	Fuseblocks, Compressor #1 & #2	Cond./Fuse Ctrl Box
FB8	Fuseblock, Main Transformer	Main Control Box
FB9, 10	Fuseblocks, Supply Fan	Main Control Box
FB11-18	Fuseblocks, Condenser Fans	Cond. Control Box
FB19, 20	Fuseblocks, Return Fan	Main Control Box
FB31-40	Fuseblocks, Electric Heat (Top Bank)	Electric Heat Sect.
FB41-50	Fuseblocks, Electric Heat (Bottom Bank)	Electric Heat Sect.
FD	Flame Detector	Furnace Sect.
FLC	Fan Limit Control	Furnace Sect.
FS1	Freezestat Control	Heat Sect.
FSG	Flame Safeguard	Furnace Sect.
GFS1/GFR1	Ground Fault Sensor/Relay, RPS Unit	Main Control Box
GFS3/GFR2	Ground Fault Sensor/Relay, RCS Unit	Cond. Control Box
GRD	Ground	All Control Boxes
GV1	Gas Valve, Pilot	Furnace Sect.
GV2, 3	Gas Valves, Main	Furnace Sect.
HL1-10	High Limits, Elec. Heaters, Power (Top Bank)	Electric Heat Sect.
HL11-20	High Limits, Elec. Heaters, Power (Bottom Bank)	Electric Heat Sect.
HL22	High Limit, Gas Heat (Prefilters)	Supply Air Sect.
HL23	High Limit, Gas Heat (Final Filter)	Final Filter Sect.
HL31-40	High Limits, Elec. Heaters, Control (Top Bank)	Electric Heat Sect.
HL41-50	High Limits, Elec. Heaters, Control (Bottom Bank)	Electric Heat Sect.
HP1, 2	High Pressure Controls, Refrigerant	On Compr. #1, #2
HP5	High Pressure Control. Gas	Furnace Sect.
HS1	Heat Switch, Electric, Shutdown	Main Control Box
HTR1, 2	Crankcase Heaters	On Compr. #1. #2
IT	Ignition Transformer	Furnace Sect.
LP1, 2	Low Pressure Controls, Refrigerant	On Compr.
LP5	Low Pressure Control, Gas	Furnace Sect.
LT2	Light, Furnace On	Furnace Sect.
LT3	Light, Pilot Gas Valve On	Furnace Sect.
LT4	Light, Main Gas Valve On	Furnace Sect.
LT10	Light, Supply Fan	Supply Air Sect.
LT11	Light, Return Fan	Return Air Sect.
LT12	Light, Heat Section	Heat Sect.
LT13	Light, Filter Section	Filter Sect.
LT14	Light, Final Filter Section	Final Filter Sect.
LTI 5	Light, Discharge Section	Discharge Sect.
LT16	Light, Blow-through Coil Section	Blow-thru Coil Sect.
LT17	Light, Evaporator Coil Section	Evaporator Coil Sect
LT18	Light, Preheat Section	Preheat Sect.
LT19	Light, Blank Section	Blank Sect.
LT20	Light, Blank Compartment	Blank Compartment
LT22	Light, Condenser Section	Condenser Sect.
M1, 5	Contactors, Compressor #1	Cond. Control Box
M2, 6	Contactors, Compressor #2	Cond. Control Box
Mg, 10	Contactors, Supply Fan	Main Control Box
M11-18	Contactors, Condenser Fans, Circuit #1	Cond. Control Box
M19, 20	Contactors, Return Fan	Main Control Box
M21-28	Contactors, Condenser Fans, Circuit #2	Cond. Control Box
M29	Contactor, Burner Motor	Furnace Sect.
M31-39	Contactors, Elec. Heaters (Top Bank)	Electric Heat Sect.
M41-50	Contactors, Elec. Heaters (Bottom Bank)	Electric Heat Sect.
MAT	Mixed Air Temperature Sensor	Supply Air Sect.
MCB1	Microprocessor Control Board #1	Main Control Box
MJ	Mechanical Jumpers	Terminal Blocks
MP1, 2	Motor Protectors, Compressor #1, #2	On Compr. #1, #2
NB1, 2	Neutral Blocks	Main Control Box
NB3	Neutral Block	Cond. Control Box
OAE	Outside Air Enthalpy Control	Economizer Sect.
OAT	Outside Air Temperature Sensor	Discharge Bulkhead
OBA	Output Board A, Standard	Main Control Box
OBB	Output Board B, Cooling	Main Control Box
OBC	Output Board C, Heating	Main Control Box
OL9, 10	Overload Relays, Supply Fan	Main Control Box
OL19, 20	Overload Relays, Return Fan	Main Control Box
OP1, 2	Oil Pressure Controls, Compr. #1, #2	Cond. Control Box

Legend

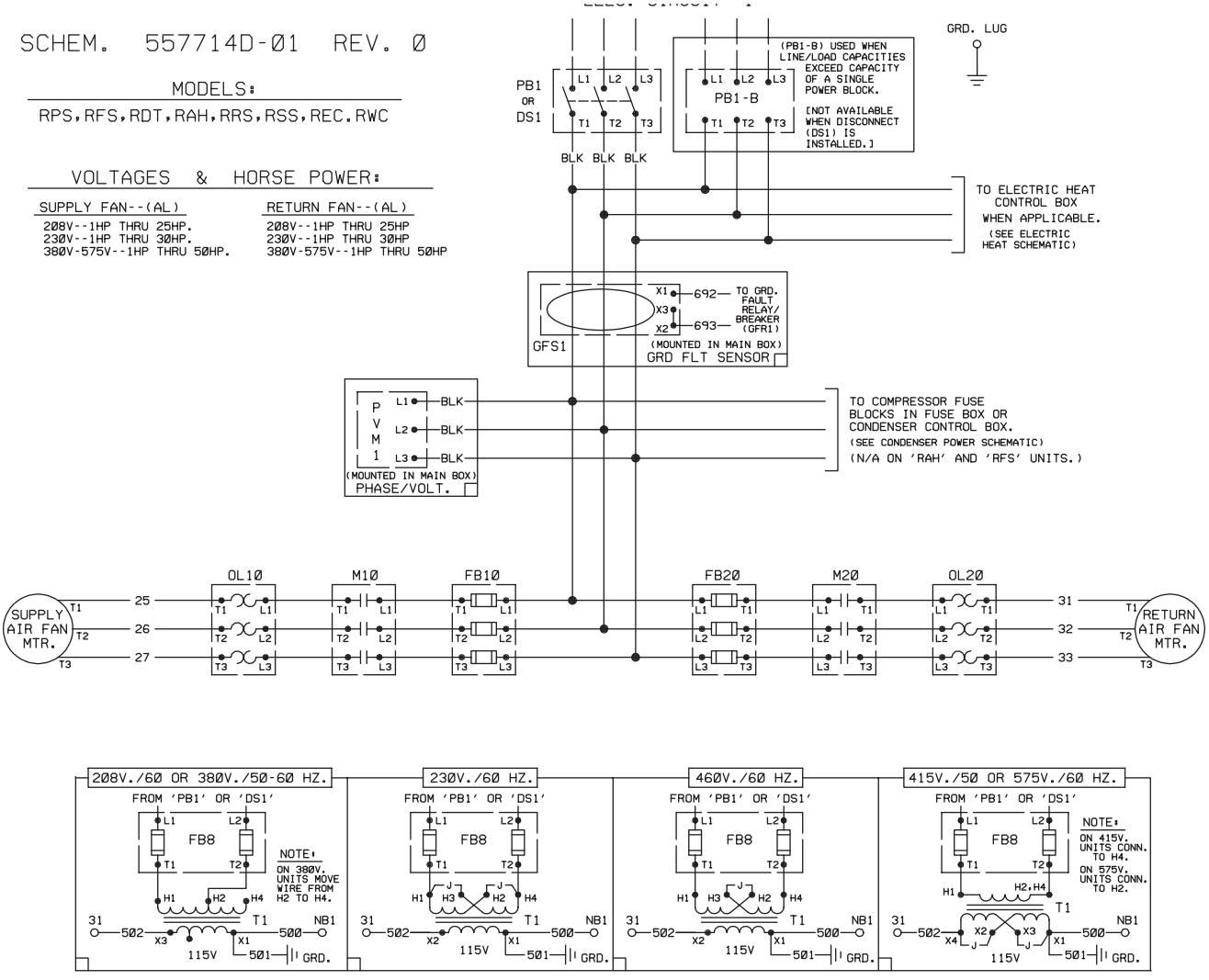
Designation	Description	Std. Location
PB1	Powerblock. Total Unit or Cond/Heat	Main Control Box
PB2	Powerblock, SAF/RAF/Controls	Main Control Box
PB3	Powerblock, Electric Heat	Electric Heat Sect.
PB4	Powerblock, Condenser	Cond. Control Box
PB9, 10	Powerblocks, Supply Fan	Unit Split Jct. Box
PB19, 20	Powerblocks, Return Fan	Unit Split Jct. Box
PC5	Pressure Control, Clogged Filter	Filter Sect.
PC6	Pressure Control. Clogged Final Filter	Final Filter Sect.
PC7	Pressure Control, Proof of Airflow	Supply Air Filter
PC8	Pressure Control, Minimum Airflow	Evaporator Coil Sect
PC12, 22	Pressure Control, FanTrol	Cond. Bulkhead
PM1	Phone Modem	Main Control Box
PS1, 2	Pumpdown Switches, Refrigerant Circuits	Cond. Control Box
PS3	Pumpdown Switch, Unit	Main Control Box
PVM1	Phase Voltage Monitor, RPS Unit	Main Control Box
PVM2	Phase Voltage Monitor, RCS Unit	Cond./Fuse Ctrl Box
R1, 2	Relays, High Pressure Reset	Cond. Control Box
R5, 6	Relays, Compressor #1, #2 Safety/Cool Fall	Cond. Control Box
R9, 10	Relays, Compressor Lockout	Cond. Control Box
R11, 12	Relays, Low Ambient	Cond. Control Box
R20	Relay, Gas, Steam, Hot Water Heat	Main Control Box
R21, 22	Relays, Gas Heat, 100% OA	Furnace Sect.
R23	Relay, Gas Heat, Modulating Valve	Furnace Sect.
R24	Relay, Gas Heat Alarm	Main Control Box
R26	Relay, Occupied/Unoccupied	Main Control Box
R27	Relay, Exhaust Dampers	Main Control Box
R28	Relay, Isolation Dampers	Main Control Box
R60-69	Relays, Special	Main Control Box
RAE	Return Air Enthalpy Sensor	Return Air Sect.
RAT	Return Air Temperature Sensor	Return Air Sect.
REC1	Receptacle, Main Box	Main Control Box
REC2	Receptacle, Condenser Box	Cond. Control Box
REC3	Receptacle, Field Power, 115V	Discharge Bulkhead
REC10-22	Receptacles, Cabinet Section	Cabinet Sections
S1	Switch, System On/Off, RPS Unit	Main Control Box
S2	Switch, System On/Off, RCS Unit	Cond. Control Box
S3	Switch, Furnace On/Off	Furnace Sect.
S6	Switch, Return Fan Vanes Adjustment	Main Control Box
S10-22	Switches, Cabinet Section Lights	Cabinet Sections
SAT	Supply Air Temperature Sensor	Discharge Sect.
SB1	Staging Board #1, Cooling	Main Control Box
SB2	Staging Board #2, Heating	Main Control Box
SC11	Speed Control, Circuit #1	Cond. Bulkhead
SC21	Speed Control, Circuit #2	Cond. Bulkhead
SD1	Smoke Detector, Supply Air	Discharge Sect.
SD2	Smoke Detector, Return Air	Return Air Sect.
SPS1, 2	Static Pressure Sensors, Duct or Building	Main Control Box
SPS5	Static Pressure Sensor, Clogged Filter	Filter Sect.
SPS6	Static Pressure Sensor, Clogged Final Filter	Final Filter Sect.
SR1-3	Sequence Relays, Electric Heat	Electric Heat Sect.
SV1, 2	Solenoid Valves, Liquid	Discharge Bulkhead
SV5-6	Solenoid Valves, Hot Gas	Discharge Bulkhead
T1	Transformer, Main Control	Main Control Box
T2	Transformer. Unit 24V	Main Control Box
T3	Transformer, Controller, 18V	Main Control Box
T4	Transformer, Exhaust Dampers	Main Control Box
T5	Transformer, Electric Heat	Electric Heat Sect.
17	Transformer, Gas Pilot Valve	Furnace Sect.
T8	Transformer. Gas Main Valve	Furnace Sect.
T10	Transformer, SpeedTrol, 24V	Cond. Control Box
T11	Transformer, SpeedTrol, 230V	Cond. Control Sect.
TB1	Terminal Block, 115V, Field	Main/Cond. Ctrl Box
TB2	Terminal Block, 24V, Field	Main/Cond. Ctrl Box
TB3, 4	Terminal Blocks, Condenser	Cond. Control Box
TB5	Terminal Block, 115V, Factory	Main Control Box
TB6	Terminal Block, 115V/24V. Factory	Main Control Box
TB7, 8	Terminal Block, 24V, Factory	Main Control Box
TB10	Terminal Block, Heating	Main Control Box
TB11	Terminal Block, Heating	Electric Heat Sect.
TB12, 13	Terminal Blocks, Electric Heat, Power	Electric Heat Sect.
TB25	Terminal Block, 11 5V, Factory	Unit Split, Jct. Box
TB27, 28	Terminal Blocks, 24V, Factory	Unit Split. Jct. Box
TC1, 2	Temperature Controls, FanTrol	Cond. Control Box
TD1, 2	Time Delays. Compr. #1, #2, Lockout	Cond. Control Box
TD5, 6	Time Delays, Compr. #1, #2, Part Winding	Cond. Control Box
TD9	Time Delay, Supply Fan Part Winding	Main Control Box
TD11, 12	Time Delays, Low Ambient	Cond. Control Box
TD19	Time Delays, Return Fan Part Winding	Main Control Box
U1, 2	Unloaders, Compressors	On Compressors
VM1	Valve Motor #1, Heating	Heating Sect.
ZNT1	Zone Temperature Sensor, Control	Field Installed
ZNT2-5	Zone Temperature Sensors, Special	Field Installed



Typical Control Circuit with Power Pack Only

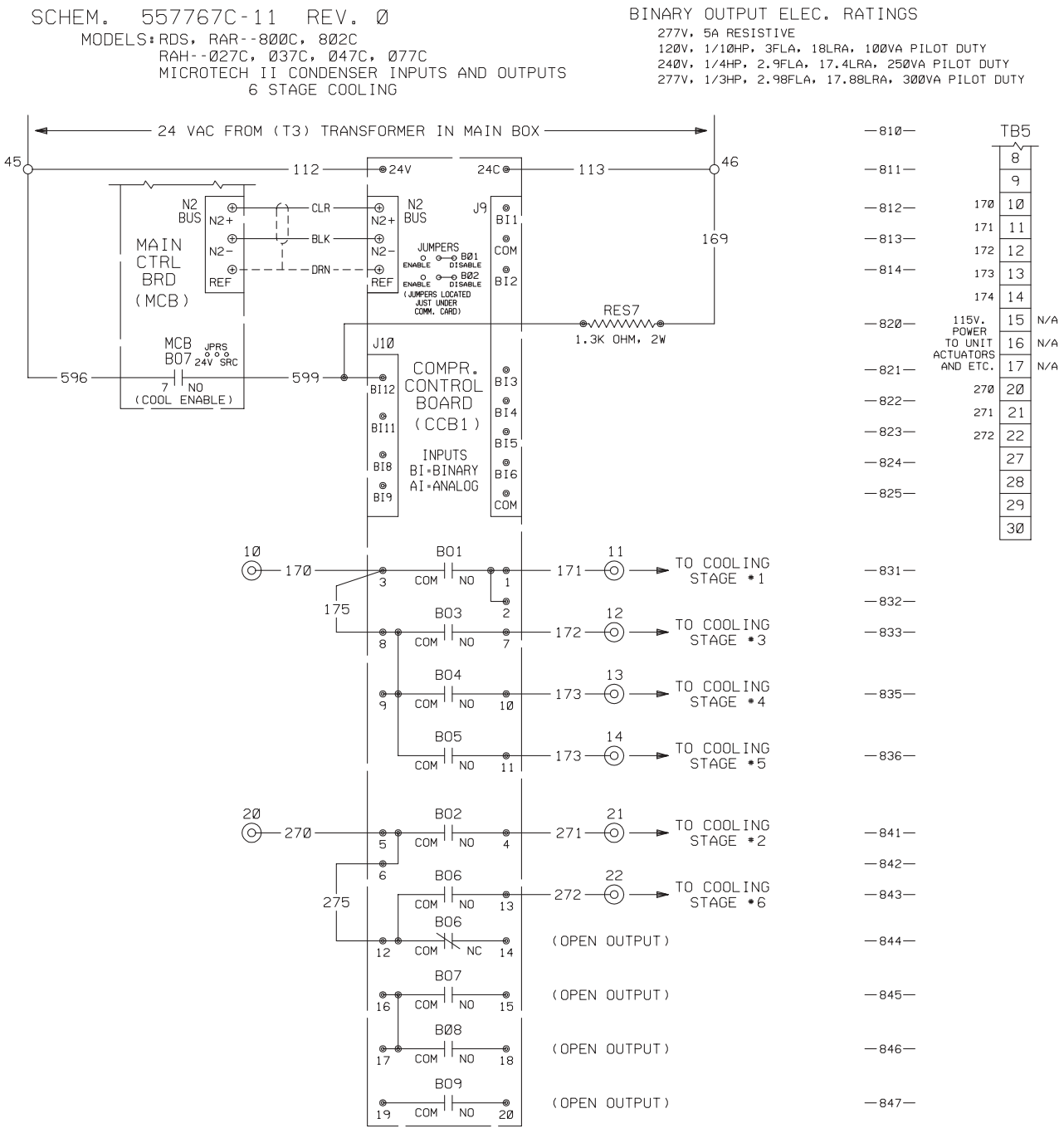


Typical Power Circuits

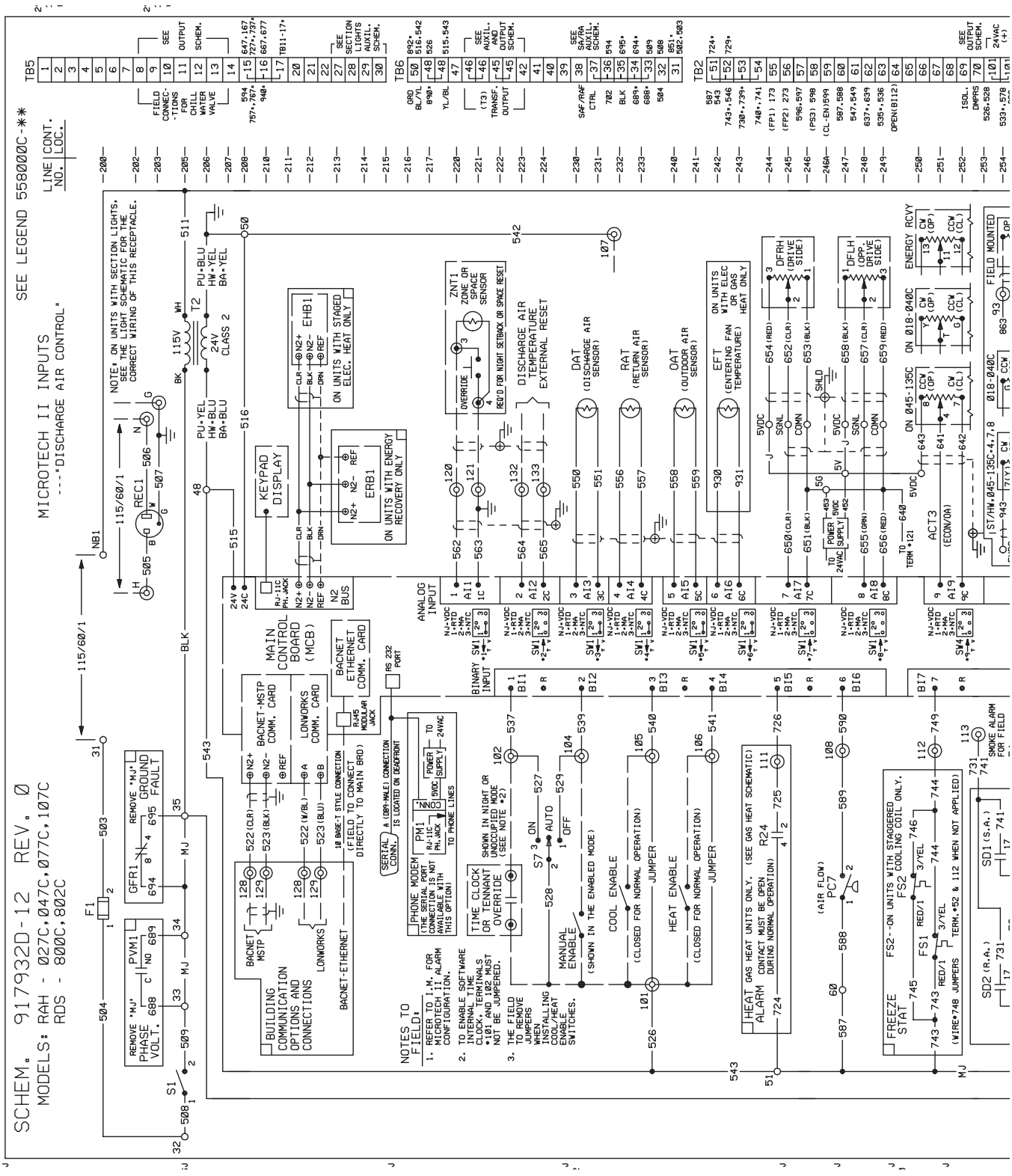


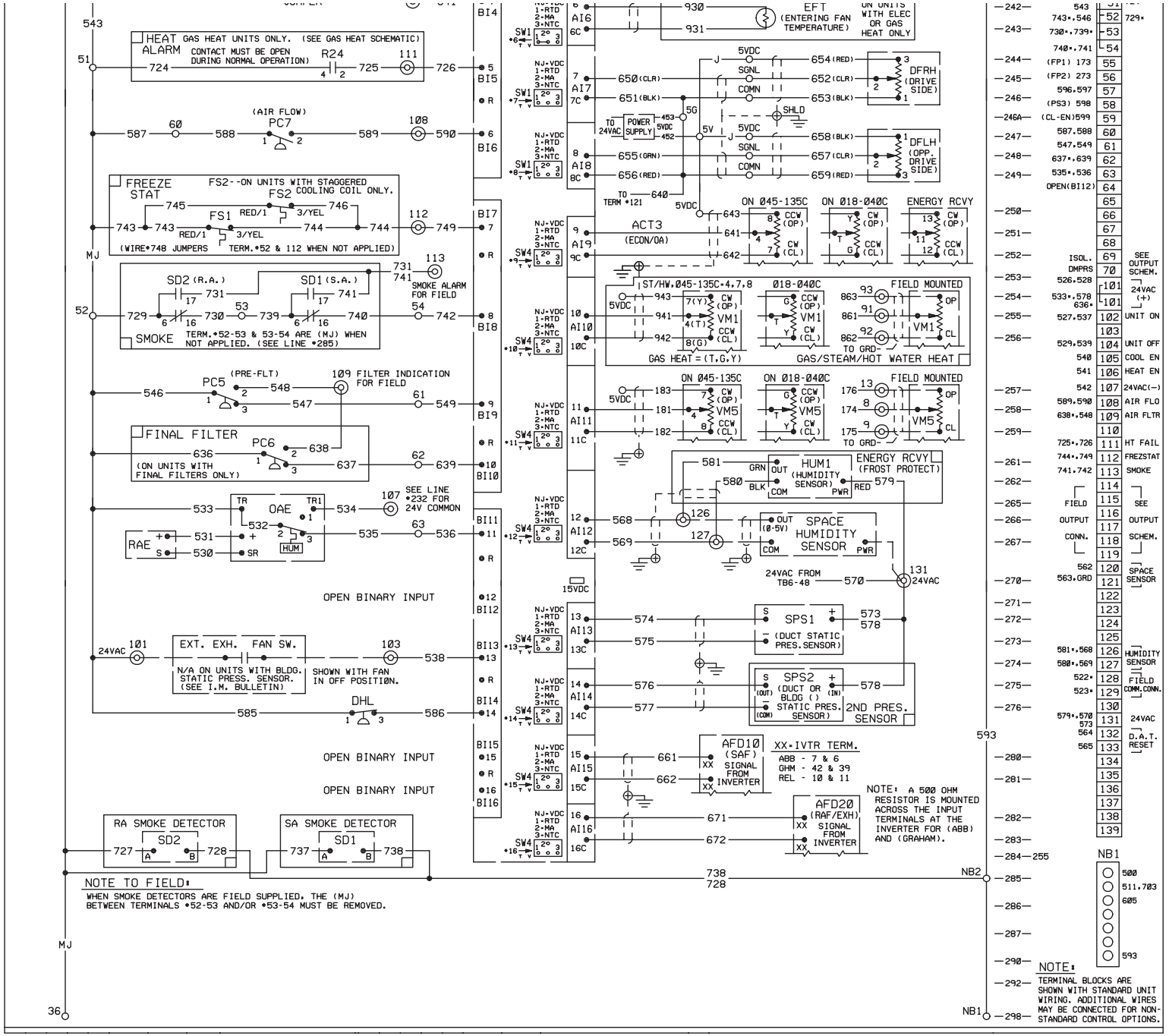
Typical Compressor Staging Outputs

For Remote Condensing Unit with MicroTech II Controls (All Terminals located on TB5)

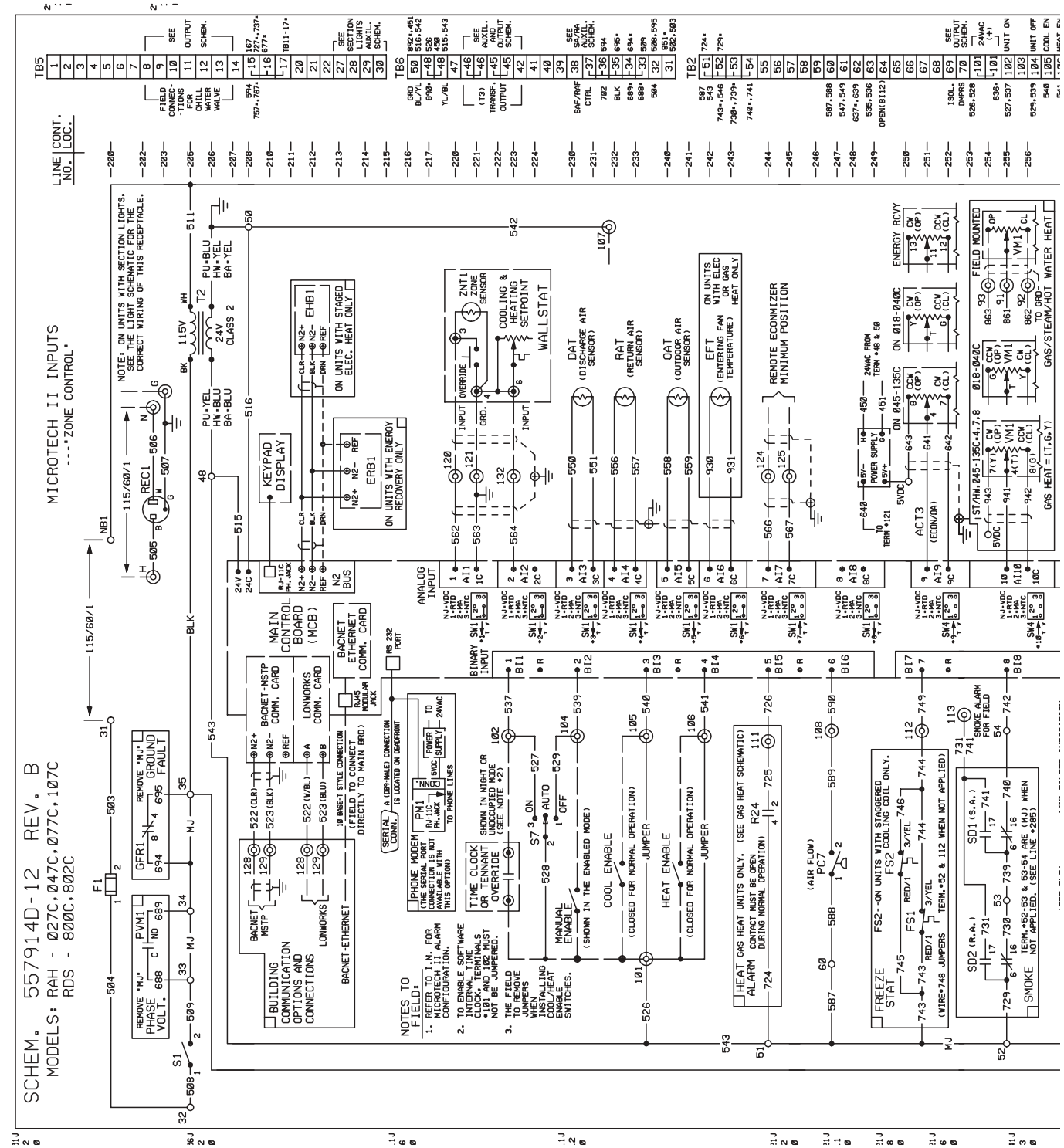


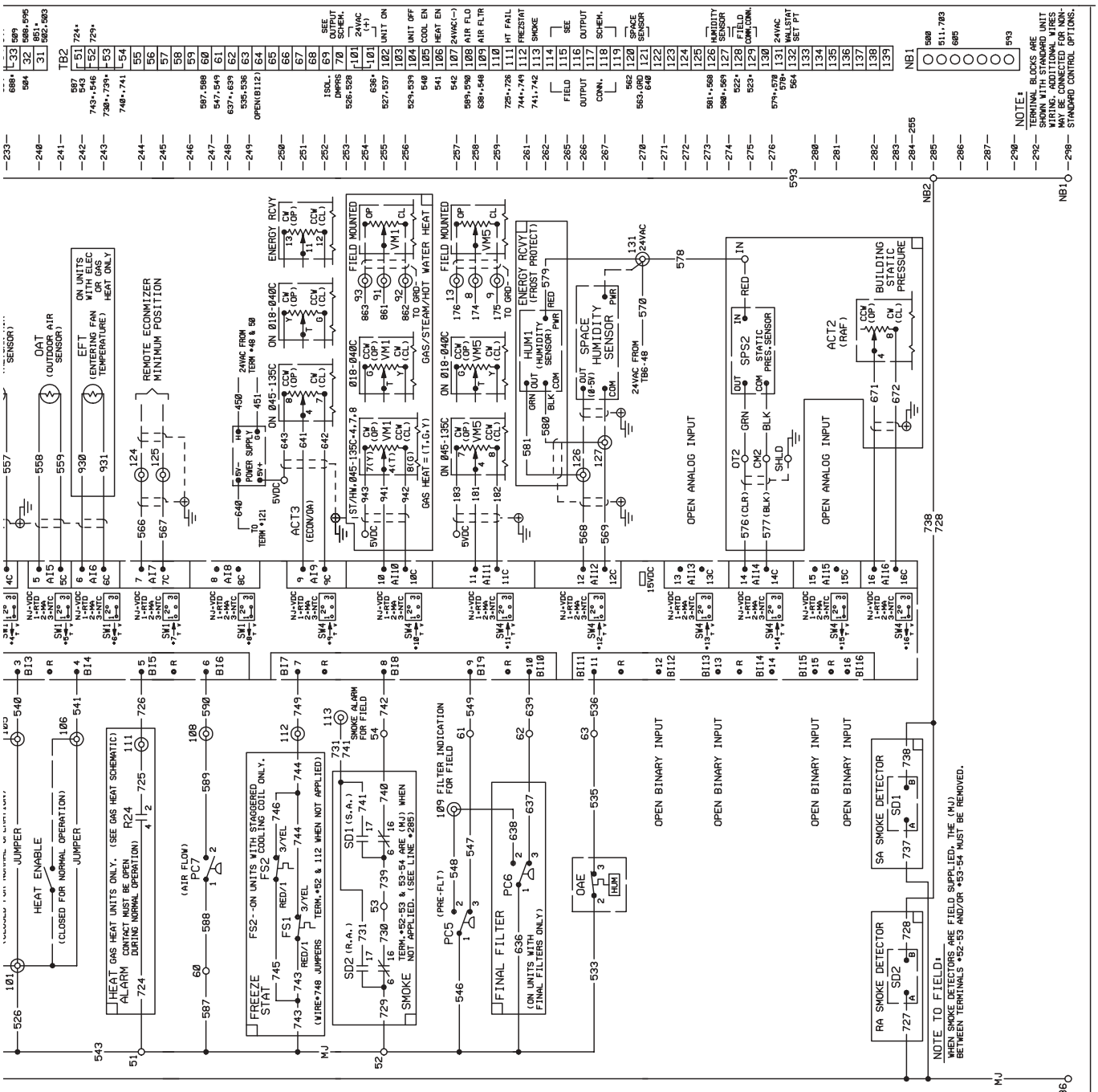
Typical Main Control Circuit (VAV Units)



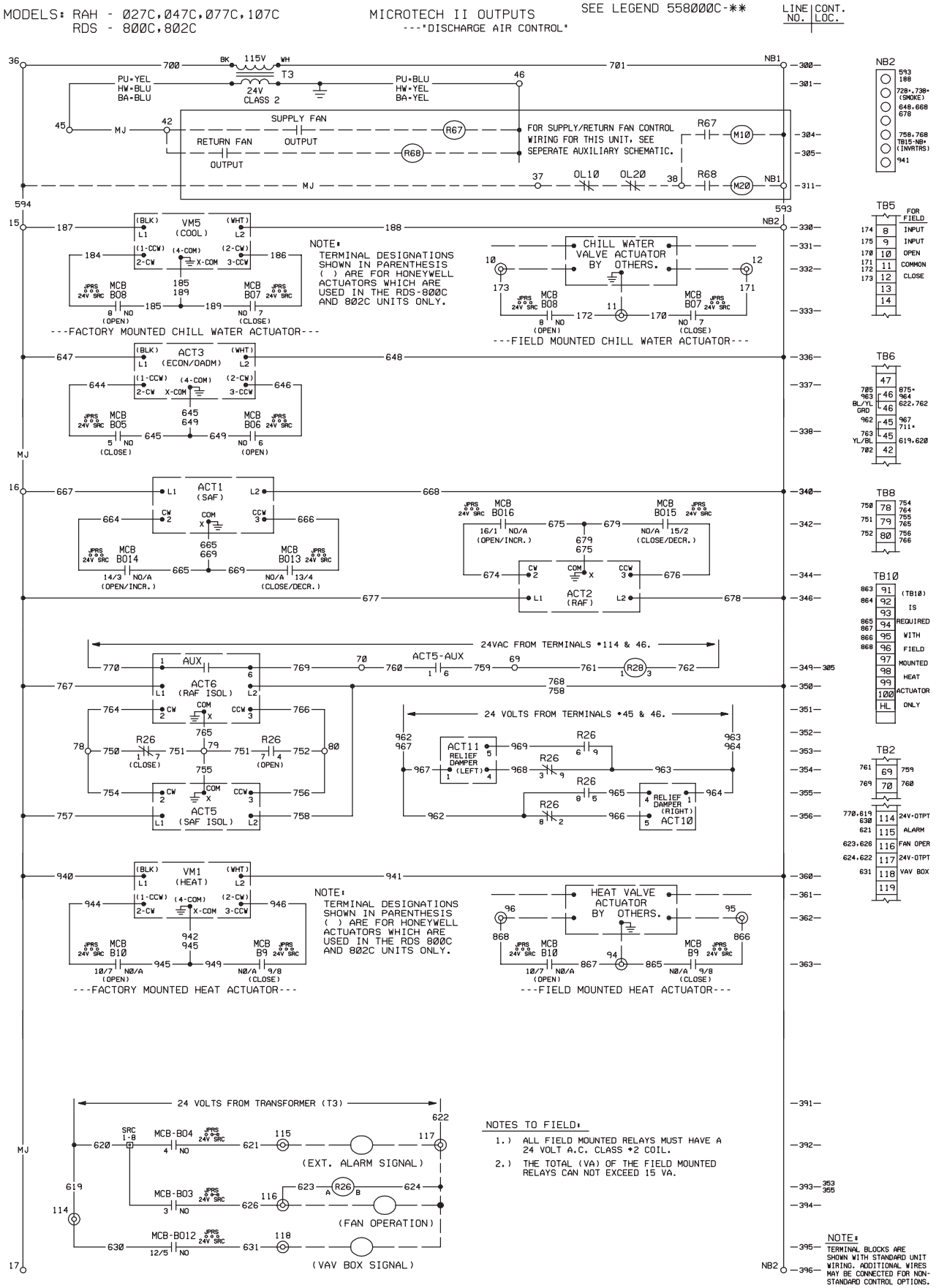

HEAT ALARM
GAS HEAT UNITS ONLY. (SEE GAS HEAT SCHEMATIC)
CONTACT MUST BE OPEN DURING NORMAL OPERATION)
R24
PC7
(AIR FLOW)
FREEZE STAT
FS2--ON UNITS WITH STAGGERED COOLING COIL ONLY.
FS1
FS2
(WIRE•748 JUMPERS TERM.•52 & 112 WHEN NOT APPLIED)
SD2 (R.A.)
SD1 (S.A.)
SMOKE
TERM.•52-53 & 53-54 ARE (MJ) WHEN NOT APPLIED. (SEE LINE •285)
SMOKE ALARM FOR FIELD
PC5 (PRE-FLT)
109 FILTER INDICATION FOR FIELD
FINAL FILTER
PC6
(ON UNITS WITH FINAL FILTERS ONLY)
OAE
RAE
107 SEE LINE •232 FOR 24V COMMON
OPEN BINARY INPUT
EXT. EXH. FAN SW.
N/A ON UNITS WITH BLDG. STATIC PRESS. SENSOR. (SEE I.M. BULLETIN)
SHOWN WITH FAN IN OFF POSITION.
DHL
OPEN BINARY INPUT
OPEN BINARY INPUT
RA SMOKE DETECTOR
SA SMOKE DETECTOR
NOTE TO FIELD:
WHEN SMOKE DETECTORS ARE FIELD SUPPLIED, THE (MJ) BETWEEN TERMINALS •52-53 AND/OR •53-54 MUST BE REMOVED.
EFT (ENTERING FAN TEMPERATURE)
ON UNITS WITH ELEC OR GAS HEAT ONLY
ACT3 (ECON/OA)
DFRH (DRIVE SIDE)
DFLH (OPP. DRIVE SIDE)
ON Ø45-135C
ON Ø18-040C
ENERGY RCVY
ST/HW,Ø45-135C•4,7,8
FIELD MOUNTED
VM1
VM5
GAS HEAT = (T,G,Y)
GAS/STEAM/HOT WATER HEAT
HUM1 (HUMIDITY SENSOR)
ENERGY RCVY (FROST PROTECT)
SPACE HUMIDITY SENSOR
24VAC FROM TB6-48
SPS1 (DUCT STATIC PRES.SENSOR)
SPS2 (DUCT OR BLDG ( ) STATIC PRES. SENSOR)
2ND PRES. SENSOR
AFD1Ø (SAF) SIGNAL FROM INVERTER
XX•IVTR TERM.
ABB - 7 & 6
GHM - 42 & 39
REL - 10 & 11
NOTE: A 500 OHM RESISTOR IS MOUNTED ACROSS THE INPUT TERMINALS AT THE INVERTER FOR (ABB) AND (GRAHAM).
AFD2Ø (RAF/EXH) SIGNAL FROM INVERTER
NOTE:
TERMINAL BLOCKS ARE SHOWN WITH STANDARD UNIT WIRING. ADDITIONAL WIRES MAY BE CONNECTED FOR NON-STANDARD CONTROL OPTIONS.
NB1
NB2
SEE OUTPUT SCHEM.
24VAC (+)
UNIT ON
UNIT OFF
COOL EN
HEAT EN
24VAC(-)
AIR FLO
AIR FLTR
HT FAIL
FREZSTAT
SMOKE
SEE OUTPUT SCHEM.
SPACE SENSOR
HUMIDITY SENSOR
FIELD COMM.CONN.
24VAC
D.A.T. RESET

Typical Main Control Schematic (CAV Units)




HEAT ENABLE
JUMPER
(CLOSED FOR NORMAL OPERATION)
JUMPER
HEAT GAS HEAT UNITS ONLY. (SEE GAS HEAT SCHEMATIC)
ALARM CONTACT MUST BE OPEN DURING NORMAL OPERATION)
R24
(AIR FLOW)
PC7
FREEZE STAT
FS2--ON UNITS WITH STAGGERED COOLING COIL ONLY.
FS2
FS1
(WIRE#748 JUMPERS TERM.#52 & 112 WHEN NOT APPLIED)
SD2 (R.A.)
SD1 (S.A.)
SMOKE ALARM FOR FIELD
SMOKE
TERM.#52-53 & 53-54 ARE (MJ) WHEN NOT APPLIED. (SEE LINE #285)
PC5 (PRE-FLT)
109 FILTER INDICATION FOR FIELD
FINAL FILTER
PC6
(ON UNITS WITH FINAL FILTERS ONLY)
OAE
HUM
OPEN BINARY INPUT
OPEN BINARY INPUT
OPEN BINARY INPUT
OPEN BINARY INPUT
OPEN BINARY INPUT
OPEN BINARY INPUT
OPEN ANALOG INPUT
OPEN ANALOG INPUT
OPEN ANALOG INPUT
OAT (OUTDOOR AIR SENSOR)
EFT (ENTERING FAN TEMPERATURE)
ON UNITS WITH ELEC OR GAS HEAT ONLY
REMOTE ECONMIZER MINIMUM POSITION
ACT3 (ECON/OA)
ACT2 (RAF)
ON 018-040C
ON 045-135C
ON 045-135C-4,7,8
018-040C
ENERGY RCVY
FIELD MOUNTED
GAS/STEAM/HOT WATER HEAT
GAS HEAT=(T.G.Y)
HUM1 (HUMIDITY SENSOR)
ENERGY RCVY (FROST PROTECT)
SPACE HUMIDITY SENSOR
BUILDING STATIC PRESSURE
SPS2 STATIC PRES.SENSOR
24VAC FROM TB6-48
24VAC FROM TERM.#48 & 50
TB2
TB1
NB1
NB2
SA SMOKE DETECTOR
SD1
RA SMOKE DETECTOR
SD2
NOTE TO FIELD:
WHEN SMOKE DETECTORS ARE FIELD SUPPLIED, THE (MJ) BETWEEN TERMINALS #52-53 AND/OR #53-54 MUST BE REMOVED.
NOTE:
TERMINAL BLOCKS ARE SHOWN WITH STANDARD UNIT WIRING. ADDITIONAL WIRES MAY BE CONNECTED FOR NON-STANDARD CONTROL OPTIONS.

Typical Actuator Circuit


MODELS: RAH - 027C,047C,077C,107C
RDS - 800C,802C
MICROTECH II OUTPUTS
---"DISCHARGE AIR CONTROL"
SEE LEGEND 558000C-**
LINE NO. | CONT. LOC.
SUPPLY FAN
RETURN FAN OUTPUT
OUTPUT
FOR SUPPLY/RETURN FAN CONTROL WIRING FOR THIS UNIT, SEE SEPERATE AUXILIARY SCHEMATIC.
NOTE: TERMINAL DESIGNATIONS SHOWN IN PARENTHESIS ( ) ARE FOR HONEYWELL ACTUATORS WHICH ARE USED IN THE RDS-800C AND 802C UNITS ONLY.
---FACTORY MOUNTED CHILL WATER ACTUATOR---
CHILL WATER VALVE ACTUATOR BY OTHERS.
---FIELD MOUNTED CHILL WATER ACTUATOR---
24VAC FROM TERMINALS #114 & 46.
24 VOLTS FROM TERMINALS #45 & 46.
NOTE: TERMINAL DESIGNATIONS SHOWN IN PARENTHESIS ( ) ARE FOR HONEYWELL ACTUATORS WHICH ARE USED IN THE RDS 800C AND 802C UNITS ONLY.
---FACTORY MOUNTED HEAT ACTUATOR---
HEAT VALVE ACTUATOR BY OTHERS.
---FIELD MOUNTED HEAT ACTUATOR---
24 VOLTS FROM TRANSFORMER (T3)
(EXT. ALARM SIGNAL)
(FAN OPERATION)
(VAV BOX SIGNAL)
NOTES TO FIELD:
1.) ALL FIELD MOUNTED RELAYS MUST HAVE A 24 VOLT A.C. CLASS #2 COIL.
2.) THE TOTAL (VA) OF THE FIELD MOUNTED RELAYS CAN NOT EXCEED 15 VA.
NOTE: TERMINAL BLOCKS ARE SHOWN WITH STANDARD UNIT WIRING. ADDITIONAL WIRES MAY BE CONNECTED FOR NON-STANDARD CONTROL OPTIONS.

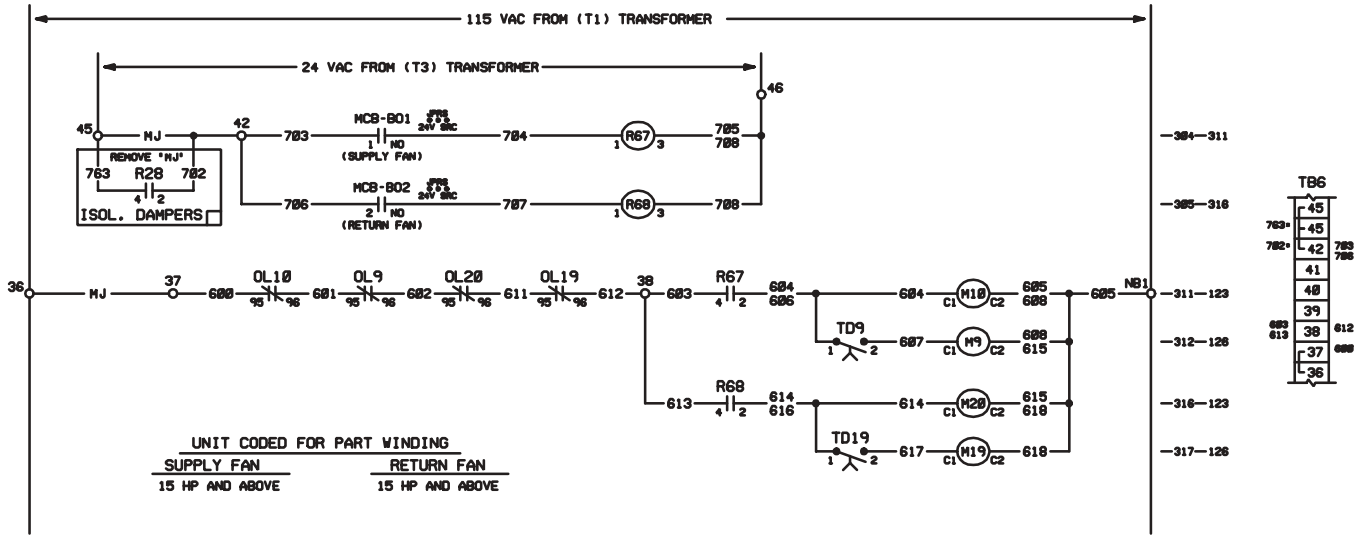
Typical Supply/Return Fan Control Circuit

MODELS: ALL ROOFTOP 'C' VINTAGE

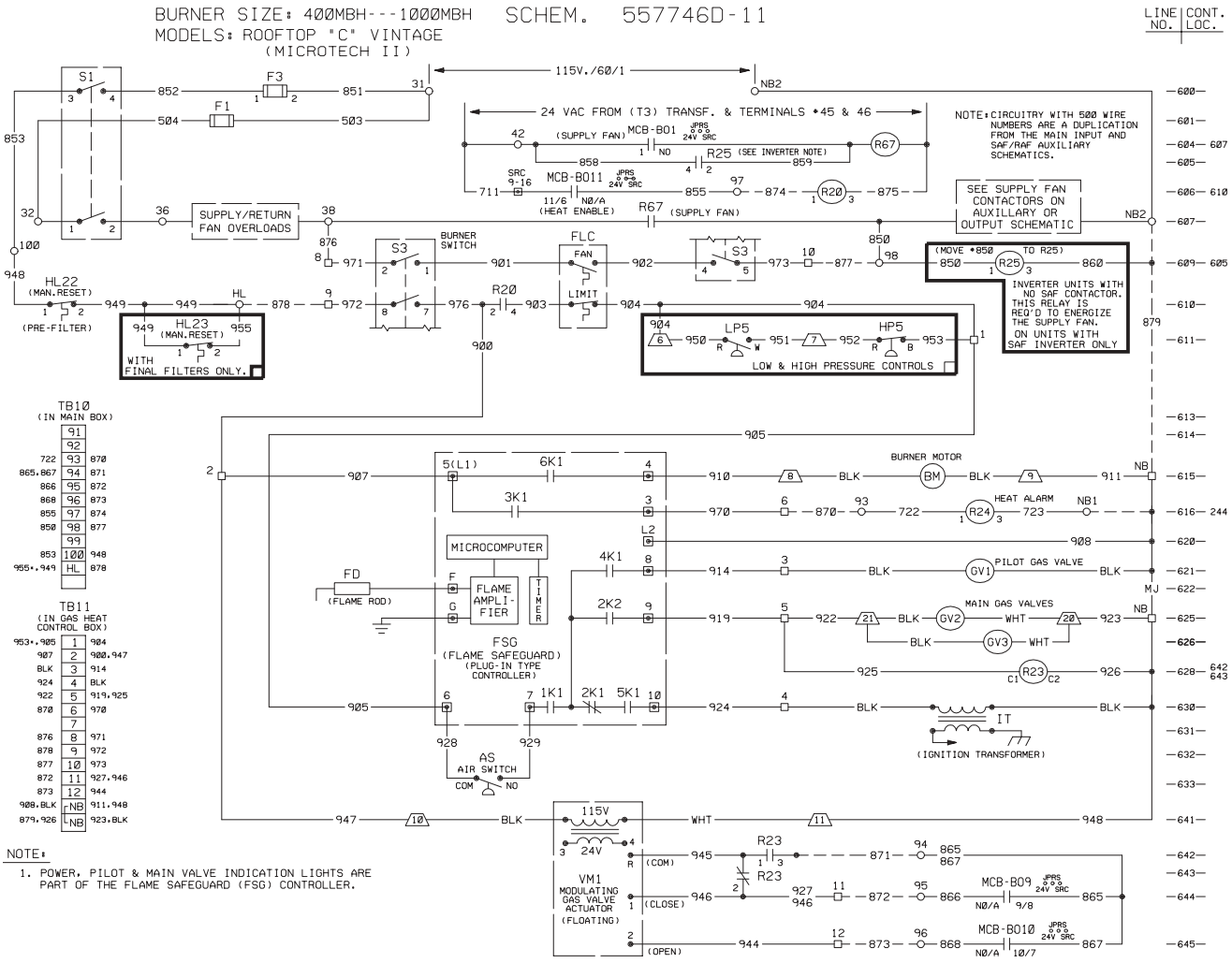
SUPPLY & RETURN FAN CONTROLS WITH A MICROTECH II SYSTEM.

SEE LEGEND 558000C-**

LINE NO. | CONT. LOC.



Typical Gas Furnace Control Circuit (Modulating Burner, Mixed Air Intake)


BURNER SIZE: 400MBH---1000MBH SCHEM. 557746D-11
MODELS: ROOFTOP "C" VINTAGE
(MICROTECH II)
LINE NO. | CONT. LOC.
115V./60/1
24 VAC FROM (T3) TRANSF. & TERMINALS •45 & 46
NOTE: CIRCUITRY WITH 500 WIRE NUMBERS ARE A DUPLICATION FROM THE MAIN INPUT AND SAF/RAF AUXILIARY SCHEMATICS.
SEE SUPPLY FAN CONTACTORS ON AUXILLARY OR OUTPUT SCHEMATIC
SUPPLY/RETURN FAN OVERLOADS
BURNER SWITCH
FLC FAN LIMIT
(SUPPLY FAN)
(SEE INVERTER NOTE)
(MOVE •850 TO R25)
INVERTER UNITS WITH NO SAF CONTACTOR. THIS RELAY IS REQ'D TO ENERGIZE THE SUPPLY FAN. ON UNITS WITH SAF INVERTER ONLY
HL22 (MAN.RESET) (PRE-FILTER)
HL23 (MAN.RESET) WITH FINAL FILTERS ONLY.
LP5 HP5 LOW & HIGH PRESSURE CONTROLS
TB10 (IN MAIN BOX)
TB11 (IN GAS HEAT CONTROL BOX)
BURNER MOTOR
HEAT ALARM
PILOT GAS VALVE
MAIN GAS VALVES
MICROCOMPUTER
FLAME AMPLI-FIER
TIMER
FD (FLAME ROD)
FSG (FLAME SAFEGUARD) (PLUG-IN TYPE CONTROLLER)
AS AIR SWITCH
IT (IGNITION TRANSFORMER)
VM1 MODULATING GAS VALVE ACTUATOR (FLOATING)
MCB-B09
MCB-B010
NOTE:
1. POWER, PILOT & MAIN VALVE INDICATION LIGHTS ARE PART OF THE FLAME SAFEGUARD (FSG) CONTROLLER.

SEQUENCE OF OPERATION

WHEN THE ROOFTOP UNIT IS ENERGIZED 120 VOLT POWER IS SUPPLIED TO THE SYSTEM ON-OFF SWITCH (S1), TO BURNER ON-OFF SWITCH (S3) AND 24 VOLTS TO THE (BO•11) CONTACTS ON THE MAIN CTRL BRD (MCB). BURNER ON-OFF SWITCH (S3) WILL POWER THE MODULATING GAS VALVE ACTUATOR (VM1) AND TERMINAL •5(L1) ON THE FLAME SAFEGUARD (FSG). UPON A CALL FOR HEAT, THE CONTROL SYSTEM WILL CLOSE (BO•11) ON THE MAIN CTRL BRD (MCB), THUS ENERGIZING RELAY (R2Ø). WHEN 120 VOLT POWER IS FURNISHED THROUGH THE SYSTEM ON-OFF SWITCH (S1), THROUGH THE BURNER ON-OFF SWITCH (S3), THROUGH RELAY (R2Ø) CONTACTS, THROUGH THE HIGH LIMIT CONTROL (FLC) AND THROUGH THE OPTIONAL AUTOMATIC RESET LOW GAS PRESSURE SWITCH (LP5) AND THE OPTIONAL MANUAL RESET HIGH GAS PRESSURE SWITCH (HP5), TERMINAL •6 ON THE FLAME SAFEQUARD (FSG) IS POWERED. THE FLAME SAFEGUARD THEN ENERGIZES ITS TERMINAL •4, WHICH POWERS THE BURNER COMBUSTION AIR BLOWER MOTOR (BM). WHENEVER POWER IS RESTORED TO THE FLAME SAFEGUARD, THE FLAME SAFEGUARD WILL GO THROUGH A 1Ø SECOND INITIATION PERIOD BEFORE THE PREPURGE PERIOD WILL BEGIN.

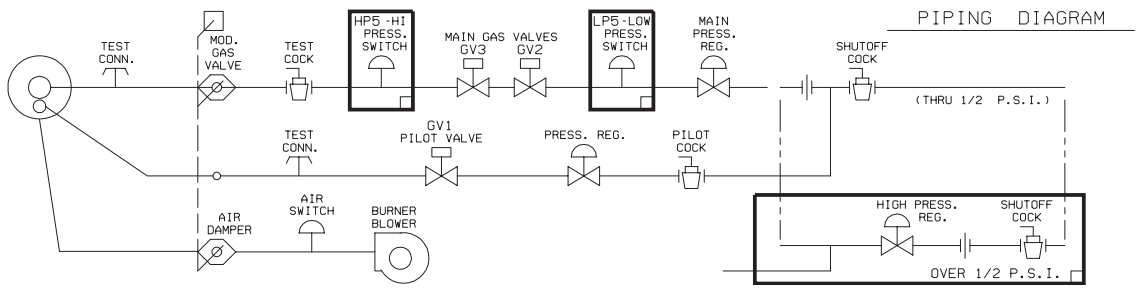
BLOWER OPERATION IS SENSED BY THE AIR SWITCH (AS), WHICH MAKES TERMINAL •6 TO •7. AFTER A 90 SECOND PREPURGE PERIOD, TERMINAL •8 (PILOT GAS VALVE--GV1) AND TERMINAL •1Ø (IGNITION TRANSFORMER--IT) WILL BE ENERGIZED. THE PILOT FLAME WILL IGNITE AND BE DETECTED BY THE FLAME SAFEGUARD THROUGH THE FLAME ROD (FD). UPON DETECTION OF PILOT FLAME, TERMINAL •1Ø (IGNITION TRANSFORMER--IT) WILL BE DE-ENERGIZED AND TERMINAL •9 (MAIN GAS VALVES--GV2 & GV3) WILL BE ENERGIZED AND THE MAIN FLAME WILL COME ON. ALSO, THE FLAME SAFEGUARD CONTAINS 'LED'S' (LOWER LEFT CORNER) THAT WILL GLOW TO INDICATE OPERATION.

LOW FIRE START IS PROVIDED BY RELAY (R23). THE RELAY DRIVES THE GAS VALVE ACTUATOR (VM1) TO THE MINIMUM FIRING RATE POSITION WHENEVER THE FLAME IS NOT ON, AND HOLDS IT THERE UNTIL THE FLAME HAS LIT AND BEEN PROVEN.

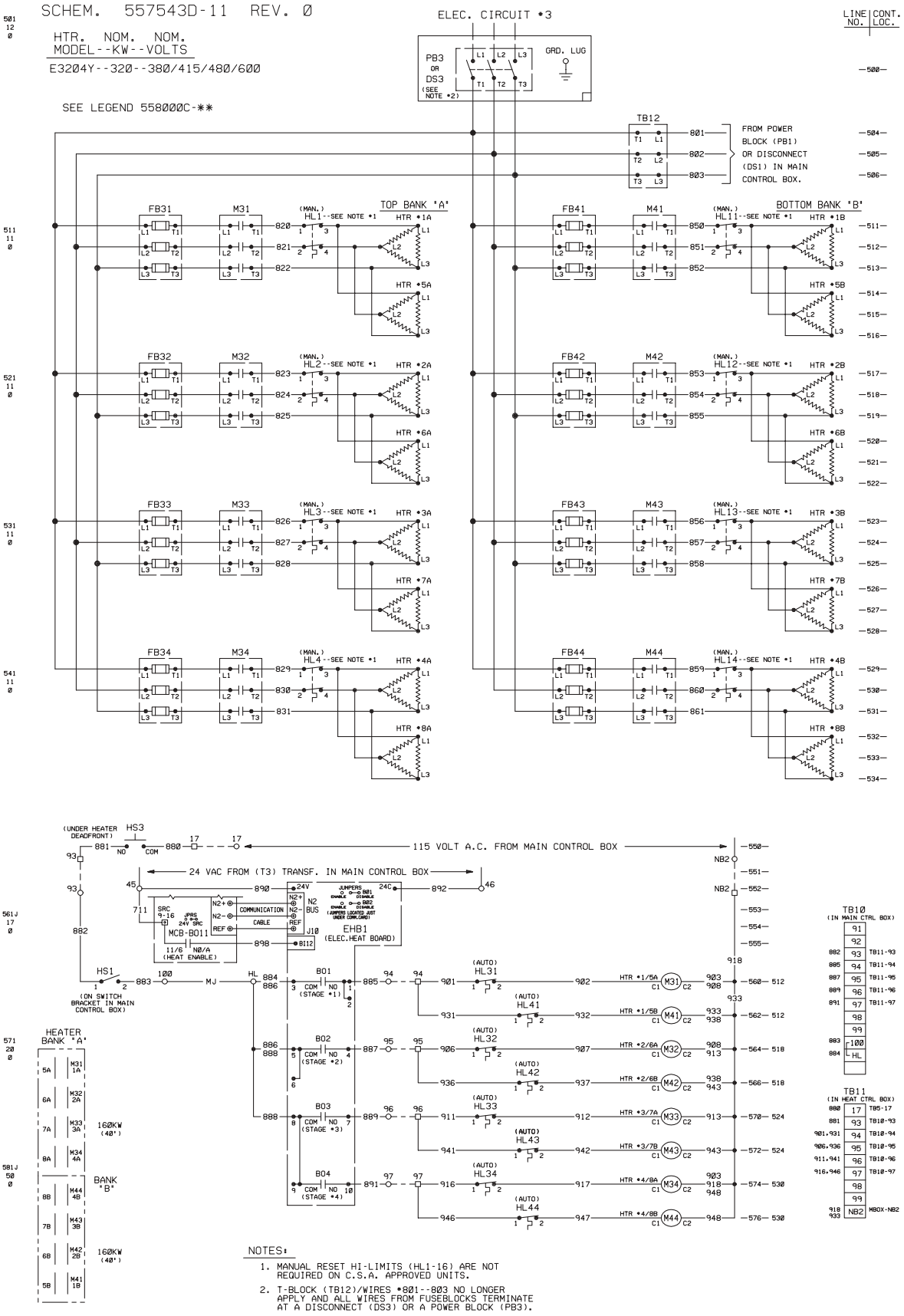
WHENEVER THE BURNER IS IN OPERATION ITS FIRING RATE WILL BE DETERMINED BY THE 'FLOATING' GAS VALVE ACTUATOR (VM1). THIS ACTUATOR POSITIONS THE BUTTERFLY GAS VALVE AND COMBUSTION AIR DAMPER AND CAN SET THE FIRING RATE BETWEEN 33% AND 100% OF NORMAL RATE. WHEN THE MAIN CONTROL SYSTEM CLOSES (BO•1Ø) ON THE MAIN CTRL BRD.(MCB), THE GAS VALVE ACTUATOR WILL REPOSITION TOWARD A HIGHER FIRING RATE UNTIL EITHER (BO•1Ø) OPENS OR THE ACTUATOR REACHES ITS MAXIMUM POSITION. WHEN THE MAIN CONTROL SYSTEM CLOSES (BO•9) ON THE MAIN CTRL BRD.(MCB), THE ACTUATOR WILL REPOSITION TOWARD A LOWER FIRING RATE. IF NEITHER (BO•9) OR (BO•1Ø) ON THE MAIN CONTROL BOARD (MCB) ARE CLOSED THE ACTUATOR WILL REMAIN AT ITS PRESENT POSITION. THE HEATING CAPACITY IS MONITORED BY THE MAIN CONTROL BOARD (MCB) THROUGH (AI•1Ø) VIA A POSITION FEEDBACK POTENTIOMETER ON THE ACTUATOR (VM1).

IN THE EVENT THE PILOT FAILS TO IGNITE OR THE FLAME SAFEGUARD FAILS TO DETECT ITS FLAME WITHIN 1Ø SECONDS, TERMINALS •4, 8, 9, AND 1Ø WILL BE DE-ENERGIZED, THUS DE-ENERGIZING THE BURNER. THE FLAME SAFEGUARD WOULD THEN BE ON SAFETY LOCKOUT AND WOULD REQUIRE MANUAL RESETTING. THE HEAT ALARM RELAY (R24) WOULD THEN BE ENERGIZED AND WOULD THEN ENERGIZE THE REMOTE 'HEAT FAIL' INDICATOR LIGHT AND SEND A FAIL SIGNAL TO BINARY INPUT •5 ON THE MICROTECH II MAIN CONTROL BOARD (MCB).

IF THE UNIT OVERHEATS, THE HIGH LIMIT CONTROL (FLC) WILL CYCLE THE BURNER, LIMITING FURNACE TEMPERATURE TO THE LIMIT CONTROL SET POINT.



Typical Electric Heat Control Circuit (Multi-Stage)


SCHEM. 557543D-11 REV. Ø
HTR. NOM. NOM.
MODEL--KW--VOLTS
E3204Y--320--380/415/480/600
SEE LEGEND 558000C-**
ELEC. CIRCUIT *3
PB3 OR DS3 (SEE NOTE *2)
GRD. LUG
LINE NO. | CONT. LOC.
TB12
FROM POWER BLOCK (PB1) OR DISCONNECT (DS1) IN MAIN CONTROL BOX.
TOP BANK 'A'
BOTTOM BANK 'B'
FB31 M31 HL1--SEE NOTE *1 HTR *1A HTR *5A
FB32 M32 HL2--SEE NOTE *1 HTR *2A HTR *6A
FB33 M33 HL3--SEE NOTE *1 HTR *3A HTR *7A
FB34 M34 HL4--SEE NOTE *1 HTR *4A HTR *8A
FB41 M41 HL11--SEE NOTE *1 HTR *1B HTR *5B
FB42 M42 HL12--SEE NOTE *1 HTR *2B HTR *6B
FB43 M43 HL13--SEE NOTE *1 HTR *3B HTR *7B
FB44 M44 HL14--SEE NOTE *1 HTR *4B HTR *8B
(MAN.)
(UNDER HEATER DEADFRONT) HS3
115 VOLT A.C. FROM MAIN CONTROL BOX
24 VAC FROM (T3) TRANSF. IN MAIN CONTROL BOX
MCB-B011
COMMUNICATION CABLE
N2 BUS
EHB1 (ELEC.HEAT BOARD)
HS1 (ON SWITCH BRACKET IN MAIN CONTROL BOX)
HL
MJ
B01 (STAGE *1)
B02 (STAGE *2)
B03 (STAGE *3)
B04 (STAGE *4)
HL31 HL41 HL32 HL42 HL33 HL43 HL34 HL44
HTR *1/5A HTR *1/5B HTR *2/6A HTR *2/6B HTR *3/7A HTR *3/7B HTR *4/8A HTR *4/8B
HEATER BANK 'A'
BANK 'B'
160KW (40')
TB1Ø (IN MAIN CTRL BOX)
TB11 (IN HEAT CTRL BOX)
MBOX-NB2
NOTES:
1. MANUAL RESET HI-LIMITS (HL1-16) ARE NOT REQUIRED ON C.S.A. APPROVED UNITS.
2. T-BLOCK (TB12)/WIRES *801--803 NO LONGER APPLY AND ALL WIRES FROM FUSEBLOCKS TERMINATE AT A DISCONNECT (DS3) OR A POWER BLOCK (PB3).

Unit Options

Enthalpy Control

Outside Air Enthalpy Control (OAE)

Units with MicroTech II control and an economizer come standard with an electromechanical enthalpy control device (OAE) which senses both the humidity and temperature of the outside air entering the unit. This device has an enthalpy scale marked A through D. *Table 12* shows the control points at 50% RH for settings A through D. *Figure 55* shows this scale on a psychrometric chart. When the outside air conditions exceed the setting of the device, the outside air dampers are positioned to the minimum outside air intake position by the MicroTech II controller.

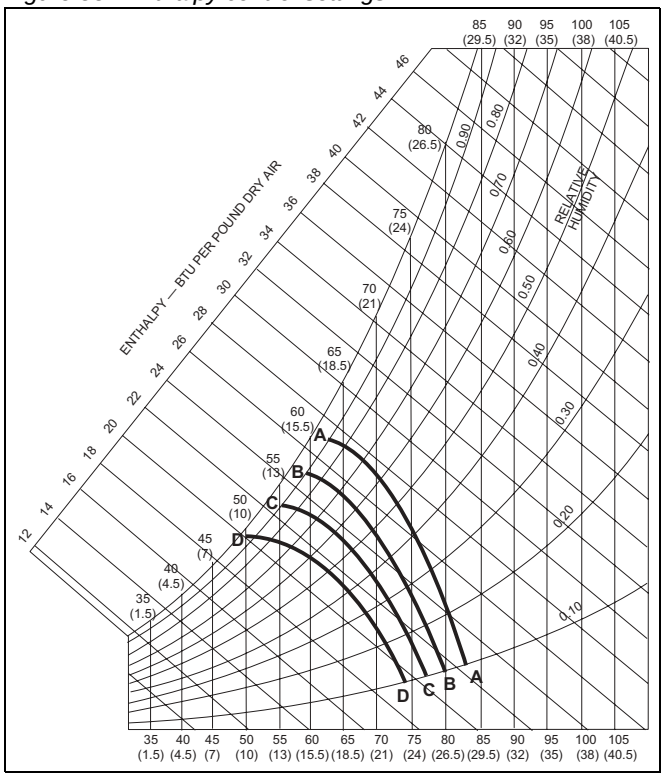
Table 12: Enthalpy control settings

CONTROL CURVE	CONTROL POINT TEMP. AT 50% RH
A	73°F (23°C)
B	70°F (21°C)
C	67°F (19*C)
D	63°F (17°C)

Differential Enthalpy Control (OAE/RAE)

An optional electric differential enthalpy control arrangement (OAE/RAE) is available on units with MicroTech II control. In this configuration a solid-state humidity and temperature sensing device is located in both the return (RAE) and outside intake (OAE) airstreams. This OAE device has the same A through D scale as the device described above. However, with the OAE/RAE arrangement the switch on OAE must be set all the way past the "D" setting. With this done, the MicroTech II controller will adjust the return and outside air dampers to use the airstream with the lowest enthalpy.

Figure 55. Enthalpy control settings



Ground Fault Protection

The ground fault protection is designed to protect motors from destructive arcing ground faults. The system consists of a ground fault relay and a ground fault current sensor. The ground fault relay employs solid state circuits that will instantaneously trip and open a set of relay contacts in the 115 volt control circuit to shut the unit down whenever a ground fault condition exists. The ground fault relay is self powered. The ground fault sensor is a current transformer type of device located on the load side of the power block through which the power wires of all phases are run.

Phase Voltage Monitor

The phase voltage monitor protects against phase loss (single phasing) when any one of three line voltages drops to 74% or less of setting. This device also protects against phase reversal when improper phase sequence is applied to equipment, and low voltage (brownout) when all three line voltages drop to 90% or less of setting. An indicator run light is "on" when all phase voltages are within specified limits. The phase voltage monitor is located on the load side of the power block with a set of contacts wired to the 115 volt control circuit to shut the unit down whenever the phase voltages are outside the specified limits.

External Time Clock

An external time clock can be used as an alternative (or in addition) to the MicroTech II controller's internal scheduling function. The external timing mechanism is set up to open and close the circuit between field terminals 101 and 102. When the circuit is open, power is not supplied to digital input DI (terminal DH1-1)on the ADI board. This is the normal condition in which the programmable internal schedule is followed. When the circuit is closed, power is fed to DH1-1. The MicroTech II controller responds by placing the unit in the occupied mode, overriding any set internal schedule.

For more information, please see the "Digital Inputs" section of Bulletin No. IM 696, "MicroTech II Applied Rooftop Unit Controller."

Smoke Detectors

Optional smoke detectors can be located at the supply and return openings. The wiring for these smoke detectors is shown on any of the "Typical Main Control Circuit" wiring schematics within the section *"Wiring Diagrams" on page 48*.

The sequence of operation for these detectors is as follows: When the smoke is detected by either sensor, the normally closed sensor contacts open. This removes power from digital input MCB BI 18 on the Main Control Board.

The MicroTech II controller responds by shutting the unit down. The controller is placed in the Alarm Off state, and cannot be restarted until the alarm is manually cleared. *Refer to the operation manual supplied with the unit for information on clearing alarms (OM138 or Om137).*

The smoke detectors themselves must be manually reset once they have tripped. Power must be cycled to the smoke detector to reset.

Freeze Protection

An optional freezestat is available on units with MicroTech II control that have hot water or steam heating coils. The sensing element is located on the downstream side of the heating coil in the heating section of the unit. If the freezestat detects a freezing condition and closes, the MicroTech II controller will take different action, depending on whether the fans are on or off. The freezestat is an auto reset type of control; however, the controller alarm it causes is a manual reset if the fan is on and auto reset if the fan is off.

Fan On Operation

If the freezestat detects a freezing condition while the fan is on, the MicroTech II controller will shut down the fans, close the outdoor air dampers, open the heating valve, and set a 10-minute timer. The MicroTech II controller's active alarm will be "Freeze Stat Fault."

When the 10-minute timer expires, the controller begins checking the freezestat again, If the freezestat is open, the heating valve will close. If the freezestat closes again, the heating valve will open, and the 10-minute timer will reset.

The unit will remain shut down until the "Freeze Stat Fail" alarm is manually cleared. *Refer to the operation manual supplied with the unit for information clearing alarms (OM138 or Om137).*

Fan Off Operation

If the freezestat detects a freezing condition while the fan is off, the MicroTech II controller will open the heating valve and set a 10-minute timer. The MicroTech II controller's active alarm will be "Freeze Problem."

When the 10-minute timer expires, the controller begins checking the freezestat again. If the freezestat is open, the heating valve will close. If the freezestat closes again, the heating valve will open, and the 10-minute timer will reset.

When the freezestat opens again, the "Freeze Stat Prob" alarm automatically clears. This feature protects the coil and allows the system to start normally after a cold night.

Mixed Air Temperature Alarm

A mixed air temperature (MAT) sensor and an associated "Low Airflow Alarm" are provided on VAV units with MicroTech II control and gas or electric heat. The MAT sensor is located in the supply fan section of the unit at the supply air funnel.

Heat will be disabled whenever the airflow is detected to be too low for safe heating operation. This condition is indicated when the supply air temperature exceeds the mixed air temperature by more than 60°F (16°C). In this case, a "Low Airflow Alarm" is generated and heat will not be re-enabled until the alarm is manually cleared. *Refer to the operation manual supplied with the unit for information on clearing alarms (OM138 or Om137).*

Duct High Pressure Limit

The duct high pressure limit control (DHL) is provided on all VAV units, including the CAV-DTC unit that can be field converted to VAV. The DHL protects the ductwork, the terminal boxes, and the unit from over pressurization which could be caused by, for example, tripped fire dampers or control failure.

The DHL control is factory set to open when the discharge plenum pressure rises to 3.5" w.c. (872 Pa). This setting should be correct for most applications; however, it is adjustable. Removing the front cover of the device reveals a scale showing the current setting. Turning the adjustment screw located on the bottom of the device adjusts the setting up or down.

If the DHL switch opens, digital input MCB BI 14 on the Main Control Board will be de-energized. The MicroTech II controller then shuts down the unit and enters the Off-Alarm state. The alarm must be manually cleared before the unit can start again. *Refer to the operation manual supplied with your unit for more information on clearing alarms (OM138 or Om137).*

Variable Inlet Vanes

Variable inlet vanes are installed on the supply and return fans of VAV units. They are also installed on the return fans of constant volume units that have direct building static pressure control capability.

The inlet vane assemblies consist of airfoil type inlet funnels with integral sets of lever-actuated radial vanes. Supply fans have one assembly on each side of the fan. Return fans have one assembly on the inlet side of the fan only. When they open, the inlet vanes direct air in the direction of wheel rotation.

The vanes are able to rotate 90 degrees from full closed to full open. A stop limits the amount of travel open and must not be changed. Driving the vanes past this stop will cause the vane hub cam linkage to disengage. The vanes will turn independently of each other, and the hub assembly will have to be overhauled. The moving parts of the vanes are permanently lubricated. All threaded fasteners must be periodically checked for tightness.

All fans with inlet vanes are provided without motor actuators for field control installation, or may be shipped from the factory with complete linkage and actuator assemblies. Field installed linkages and actuators would be connected at Point B as shown in *Figure 56 on page 63*, *Figure 57 on page 64 and Figure 58 on page 64*.

Minimum Vane Position

Operation with the inlet vanes closed completely may result in fan pulsation and excessive vibration. In units equipped with MicroTech II controls, the vanes are automatically opened approximately 5 degrees by the control system prior to fan start-up. Preset field installed linkages and actuators to close to no less than 5 degrees open.

NOTICE

Inlet vanes must not be adjusted to close tight during fan operation.

A minimum operating position of 5 degrees open is recommended to avoid pulsation.

Units with factory installed MicroTech II controls will automatically open vanes 5 degrees prior to start-up.

Actuator Rotation Adjustment

The counterclockwise (as viewed from shaft end of actuator) limit switch is adjustable on the Barber-Colman actuator. The clockwise limit is not adjustable. The counterclockwise limit setting can be changed in the field by inserting a screwdriver through the opening in the top plate directly ahead of the terminal block on the shaft side and engaging the screwdriver blade with the edge of the notched cam nearest the front of the actuator. Turning the cam clockwise (as viewed from the shaft) increases the amount of actuator rotation. Each click of the cam represents about 3 degrees of change in actuator rotation. Set the actuator for 180-degree rotation.

DWDI Housed Supply Fan Vane Adjustment

Figure 56 on page 63 shows the supply fan vane linkage assembly. Both sets of vanes on the supply fan must operate in unison. Adjustments to the motor rod end and locknut (Point A) as well as to the floating link ends (Point C) can be made to provide uniformity between the linkage assemblies.

The vane actuators must have 180-degree rotation. Do not make linkage adjustments to compensate for improper actuator rotation, but correct the actuator rotation adjustment. Refer to *"Actuator Rotation Adjustment"*

Note: There are three different actuator rotation configurations. These are shown as three views in *Figure 56 on page 63*. Refer to *Table 13* to determine which view applies to a particular unit.

On units with vane controls on both the supply and return fan, it is important that both actuators have exactly 180-degree rotation to provide proper 'tracking" of the two actuators.

SWSI Supply Fan Vane Adjustment (RAH Only)

Refer to *Figure 57 on page 64* for 40" wheels, *Figure 58 on page 64* 44" wheels, *and Figure 59 on page 65* for 49" wheels. The vane actuator must have 180-degree rotation. Do not make vane adjustments to compensate for improper rotation, but correct the actuator rotation adjustment. (Refer to *"Actuator Rotation Adjustment"*)

As the actuator moves from 0 degrees to 180 degrees, the vanes should move from 0 degrees (closed) to 90 degrees (full open). This can be adjusted by changing the linkage rod length by loosening the nut and sliding the rod at Point A or Point B and retightening the nut.

Return Fan Vane Adjustment

Refer to Figure 57 on page 64 for 40" wheels in the RAH 47, *Figure 58 on page 64* for 44" wheels and *Figure 62 on page 66* for all RDS 800-802 return fans (30" and 40" wheels). The vane actuator must have 180-degree rotation. Do not make linkage adjustments to compensate for improper rotation, but correct the actuator rotation adjustment. (Refer to *"Actuator Rotation Adjustment"*)

As the actuator crankarm rotates from 0 degrees to 180 degrees, the vanes should move from 0 degree (closed) to 90 degrees (full open). This can be adjusted by changing the linkage rod length by loosening the nut and sliding the rod at Point A or Point B and retightening the nut.

Figure 56. DWDI Housed Supply Fan Vane Assembly

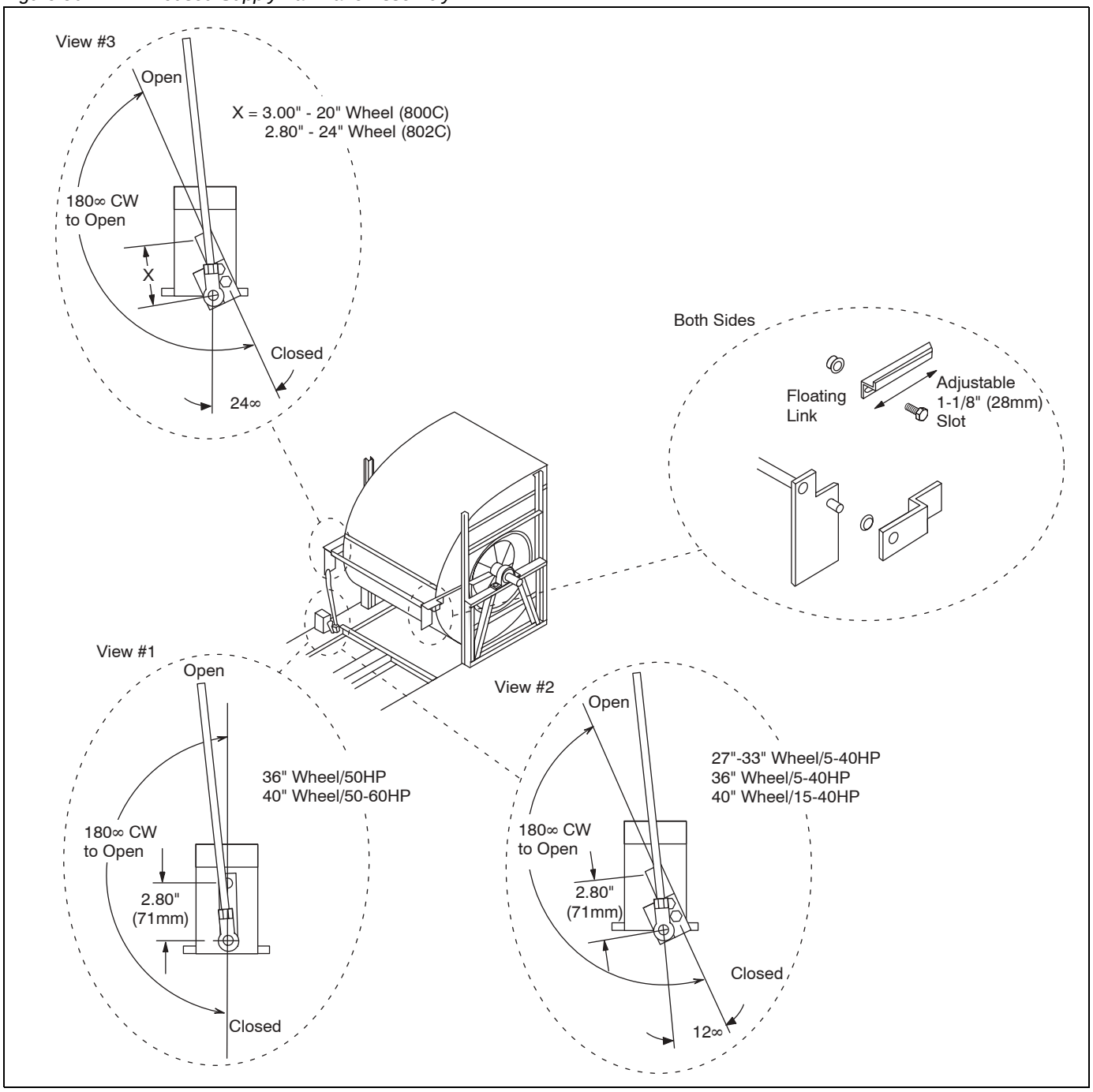


Table 13: Applicable Actuator Linkage Configurations

Supply Fan Wheel Size in Inches (mm)	"Z" (Refer to *Figure 56 on page 63*)	Motor HP	*Figure 56 on page 63* Reference View
27	38.1 (968 mm)	5 — 40	2
30	42.3 (1074 mm)	5 — 40	2
33	46.4 (1179 mm)	5 — 40	2
36	51.5 (1308 mm)	5 — 40	2
36	51.5 (1308 mm)	50 — 60	1
40	56.8 (1443 mm)	15 — 40	2
40	56.8 (1443 mm)	50 — 75	1
20	29.8 (757 mm)	1 — 25	3
24	35.9 (912 mm)	1 — 25	3

Figure 57. Supply Fan Assembly (40" Wheels)

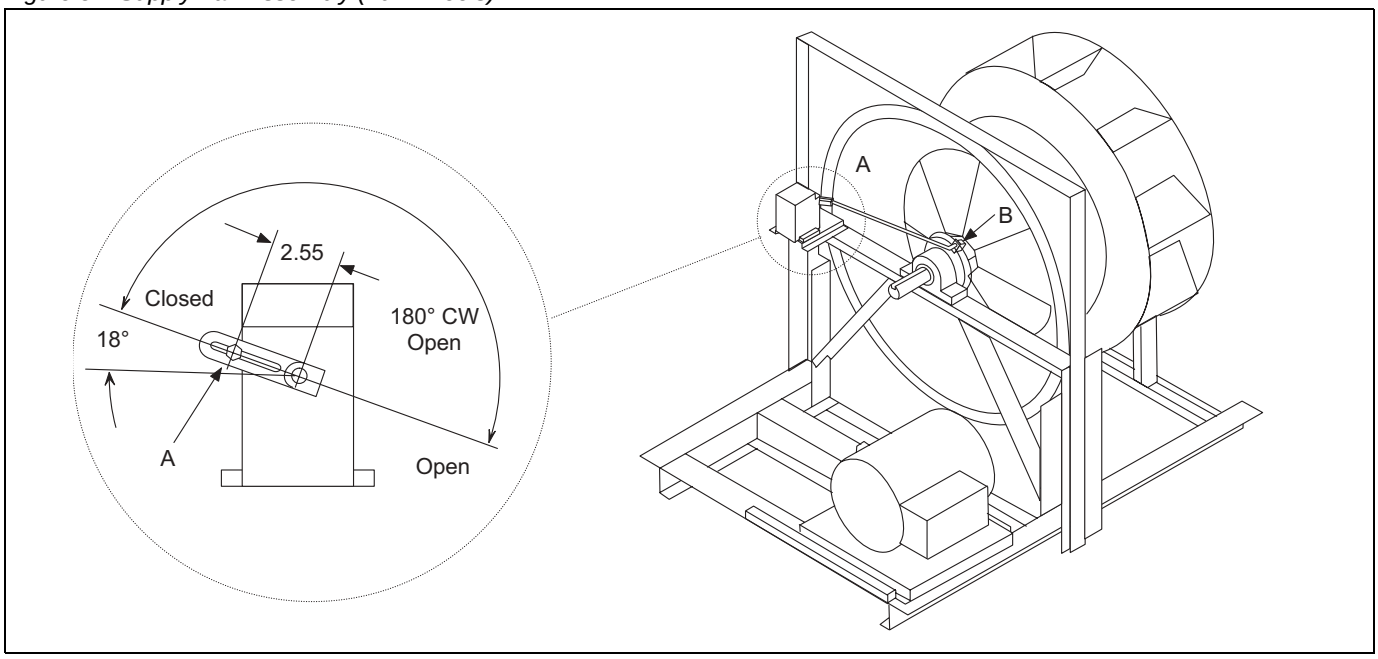


Figure 58. Supply Fan Assembly (44" Wheels)

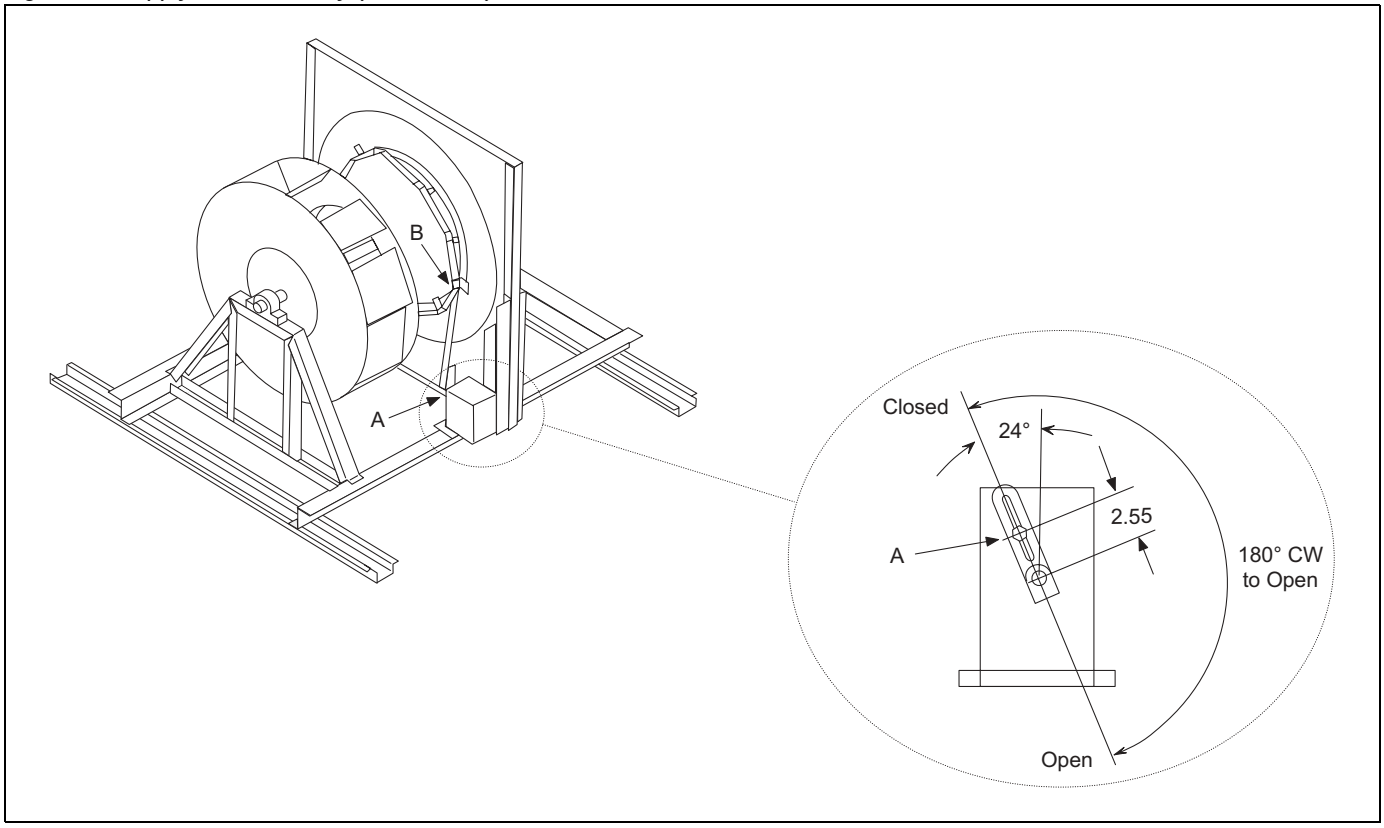


Figure 59. Supply Fan Assembly (49" Wheels)

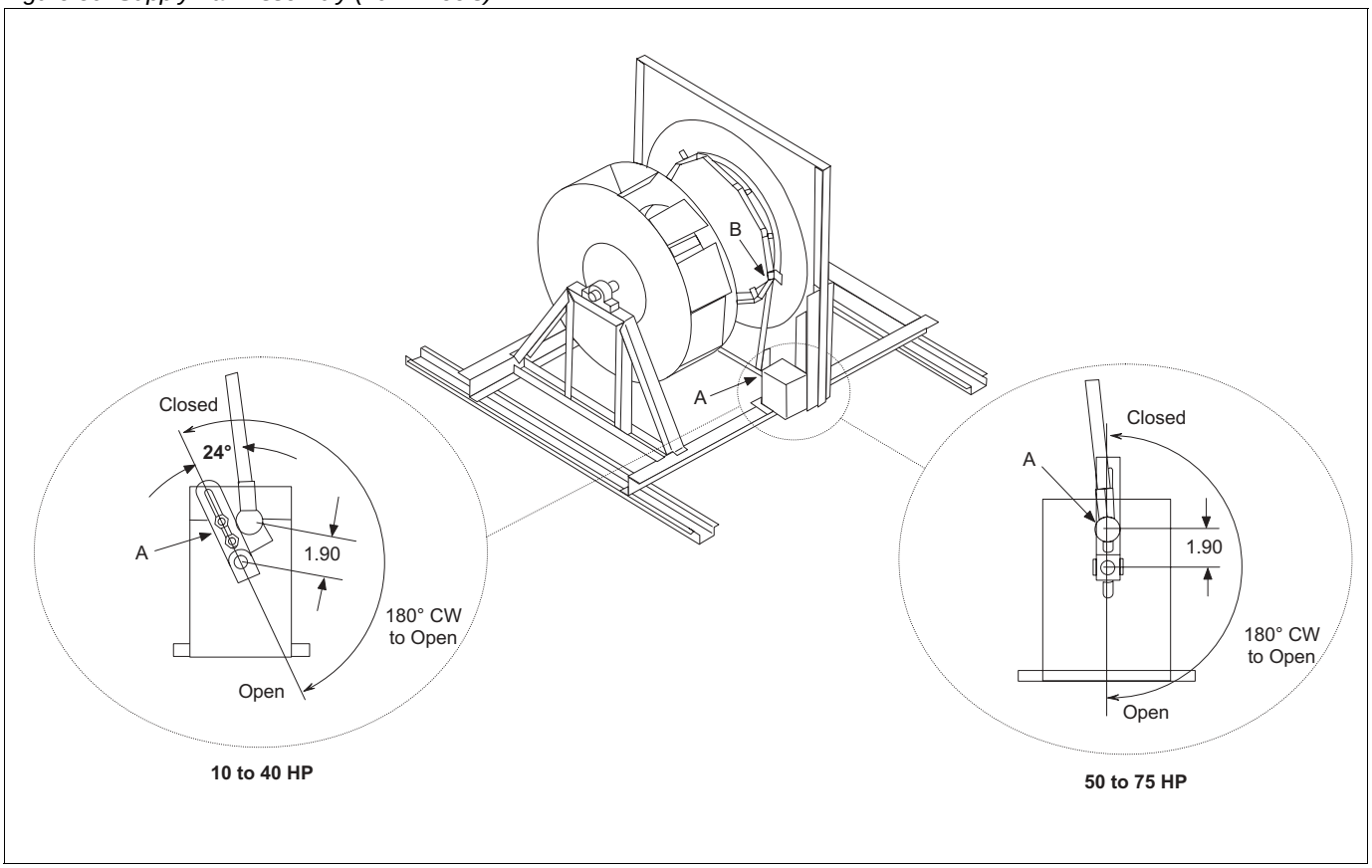


Figure 60. Return Fan Vane Assembly (40" Wheels)

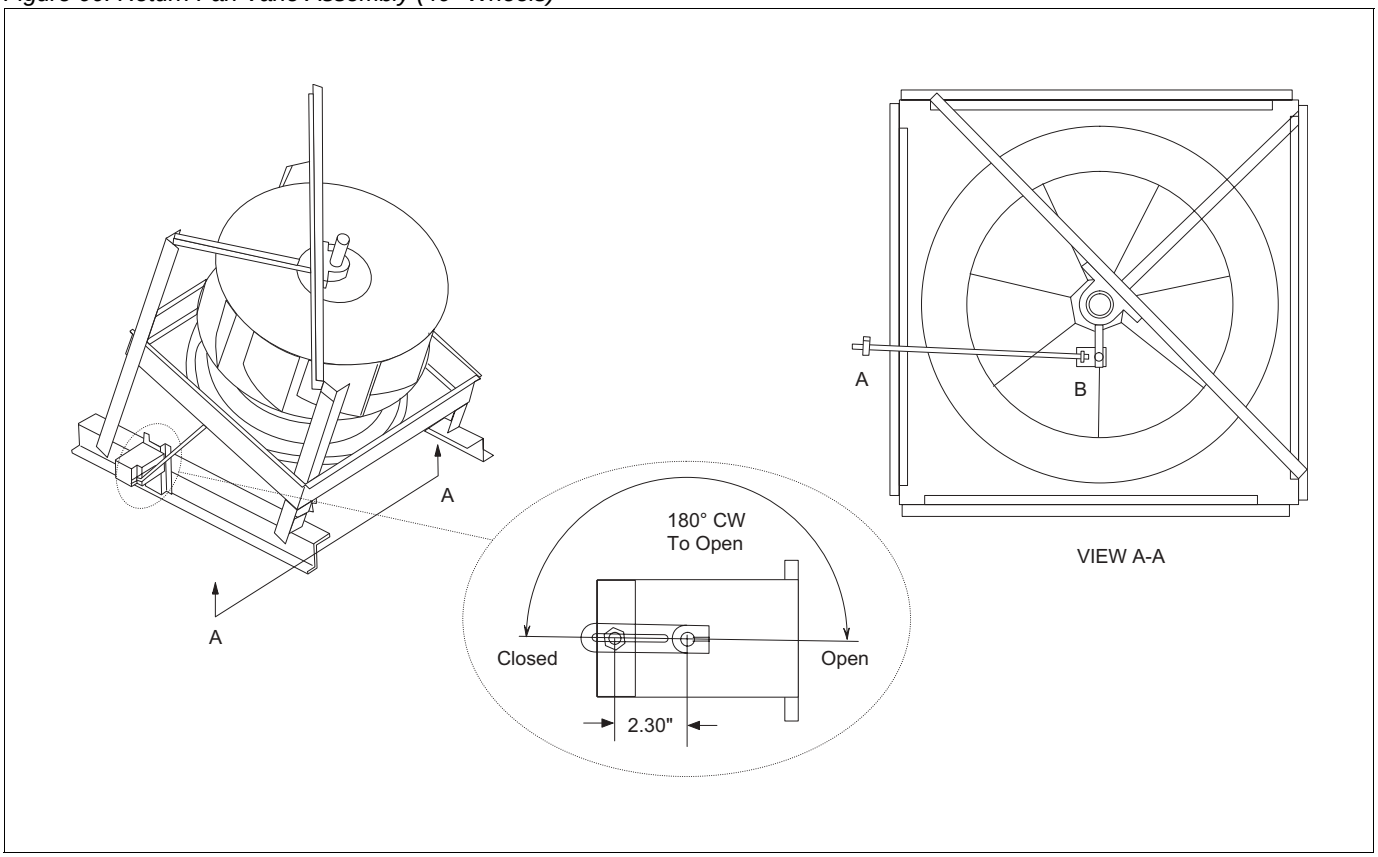


Figure 61. Return Fan Vane Assembly (44" Wheels)

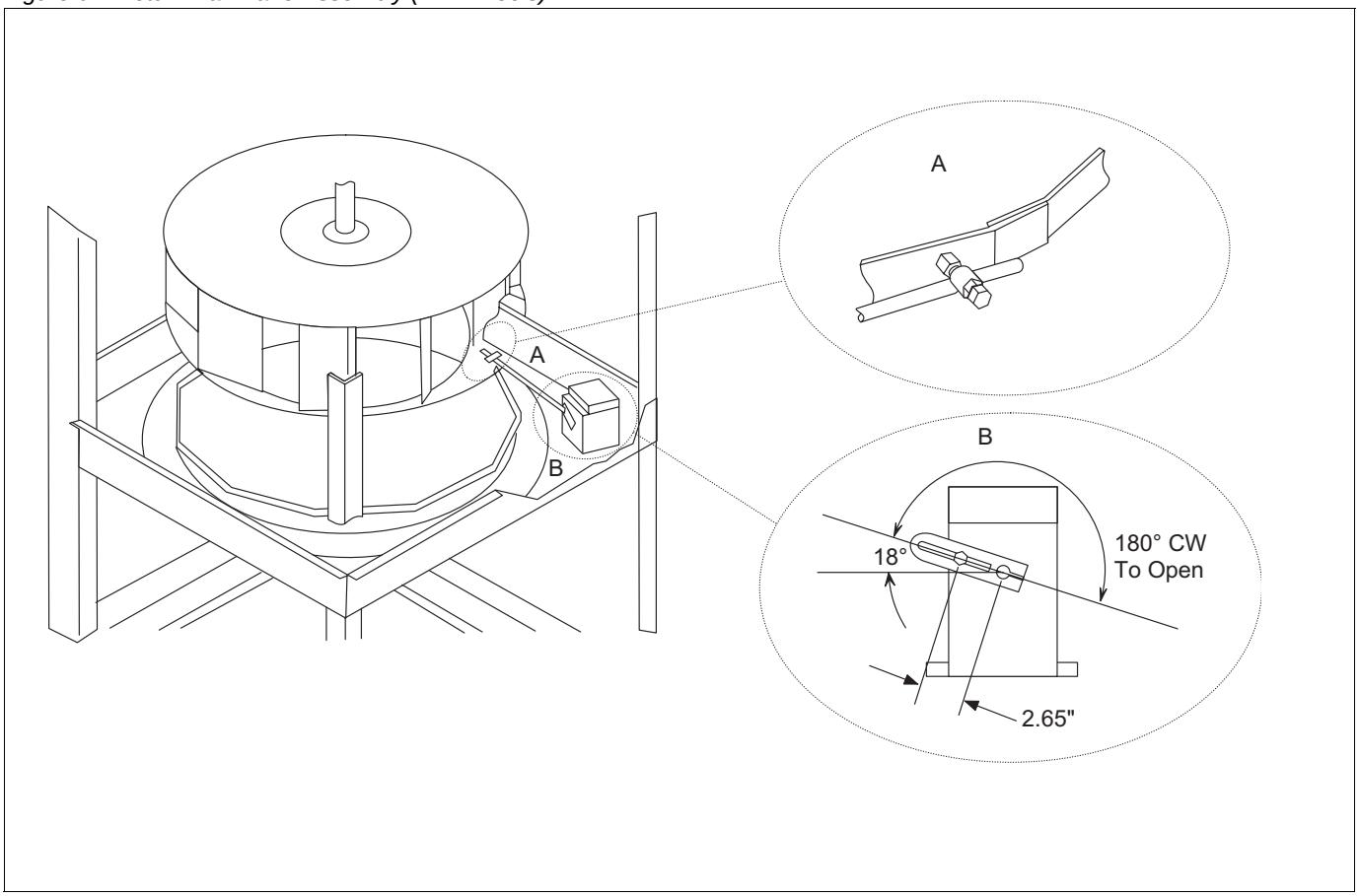
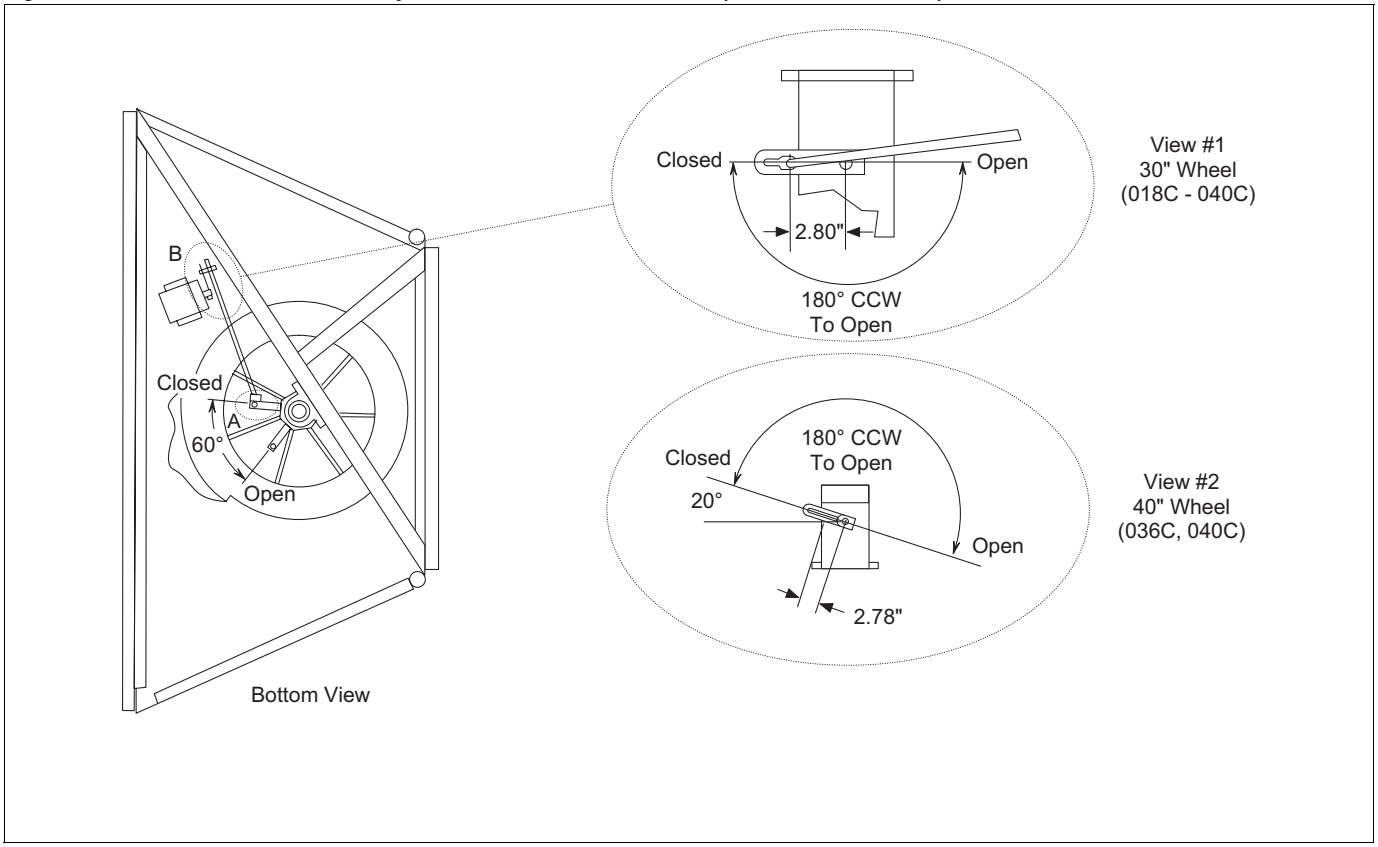


Figure 62. Return Fan Vane Assembly - RDS 800-802 Return Fans (30" and 40" Wheels)



Variable Frequency Drive Operation

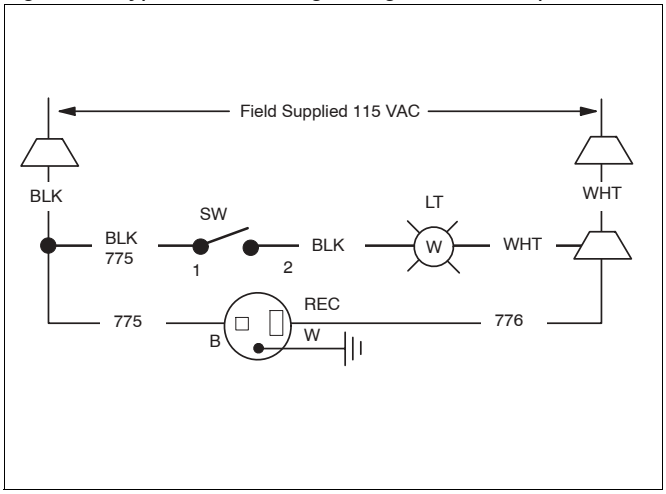
Refer to the vendor instructions supplied with the unit.

Convenience Receptacle/Section Lights

A convenience receptacle is provided in the main control box on all units. To utilize this receptacle, a separate field supplied 115V power wiring circuit must be connected to the 115V field terminal block TB1, located in the main control box. Note that the National Electrical Code requires that this circuit be protected by a ground fault circuit interrupter (GFCI) device.

Optional lights are available for certain sections in the unit. Each light includes a switch and convenience receptacle, and is powered by the external 115V power supply connected to TB1.

Figure 63. Typical Field Wiring for Lights and Receptacles



DesignFlow™ Outdoor Air Damper Option

DesignFlow™ airflow measurement stations are located inside the louvered outdoor air intake doors between the intake louver and outside air dampers. Essentially, they consist of a vane that is repositioned by airflow, the amount of rotation indicating the amount of airflow. They have been precision calibrated at the factory and no further calibration is required. However, a leveling adjustment is required. The DesignFlow unit must be accurately leveled so that when operating it will be orientated the same as when it was calibrated.

The rotational position of the DesignFlow unit vane is translated into CFM by the microprocessor in the MicroTech II control system. The position of the vane is determined by two things - the force of the airflow impacting the vane and the gravitational effect on the vane. Gravity is the only factor at the lower CFM end of the range. On a correctly leveled unit, this gravitational effect will be the same as when the unit was calibrated in the factory.

Both the right-hand and left-hand DesignFlow stations must be accurately leveled. To accurately level a station, a precise mechanical force is applied against the vane. That force should cause the vane to move to a specific position if the DesignFlow unit is correctly leveled. If the vane does not move to the correct position with the force applied, the DesignFlow unit is not properly leveled and gravity is causing the difference.

The DesignFlow unit is mounted such that it pivots at the top. A lock nut, a slotted hole, and a threaded adjuster allow positioning the bottom of the assembly so it can be correctly leveled. When the lock nut is loosened, the threaded adjuster allows precise, controlled movements. Make sure that power has been supplied to the unit. The leveling component can be found in the main control box.

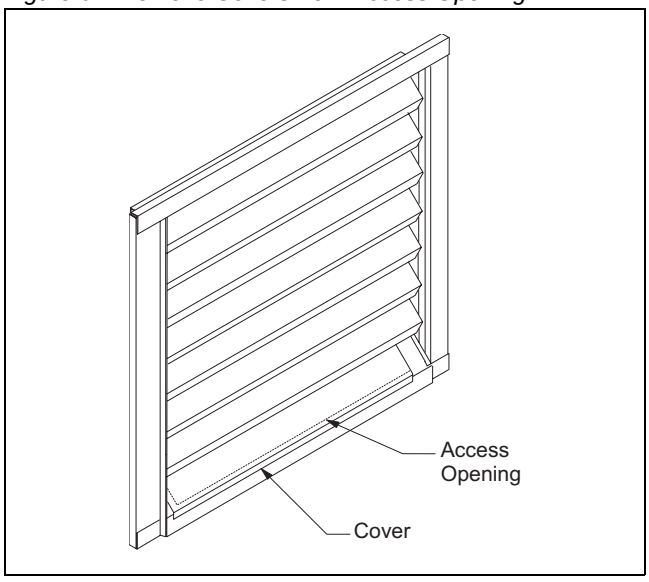
DesignFlow Airflow Measurement Station Startup:

Note: Before starting the station startup procedure, locate the leveling components kit that can be found in the main unit control box.

Note: Before starting the station startup procedures, verify that power has been supplied to the unit's MicroTech II control system. The DesignFlow startup procedure cannot be completed without use of the MicroTech II controls.

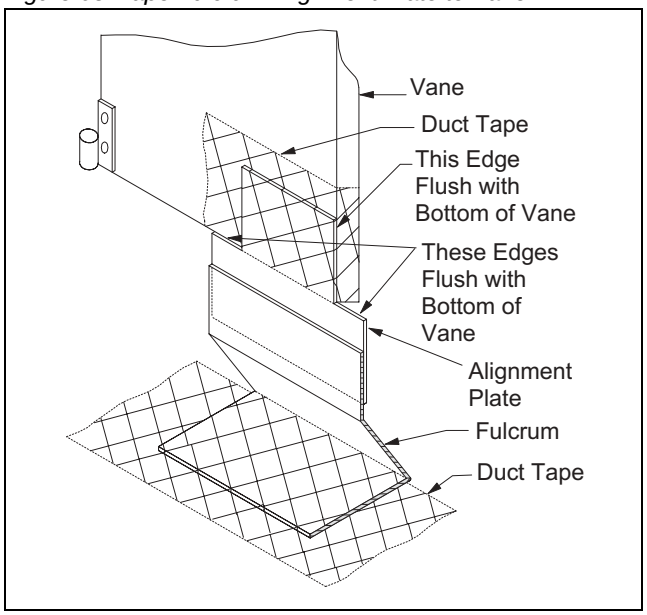
1. The swinging vanes on the measurement stations have been locked in place for shipment. The stations are accessible when the louvered outdoor air intake doors are opened. Remove the two shipping screws from each vane. One screw is located one inch from the top of the vane. The other is one inch from the bottom of the vane. Both are about eight inches in from the outer edge of the vane.
2. Examine the station for shipping damage. Manually rotate the vane and verify that it does not rub against anything. Close and latch the louvered intake door.
3. Remove the covers from the access opening in the bottom blade of the outdoor air intake louvers *(See Figure 64)*. The leveling procedure must be accomplished with the louvered door in the closed position. These openings provide access for leveling.

Figure 64. Remove Covers from Access Opening



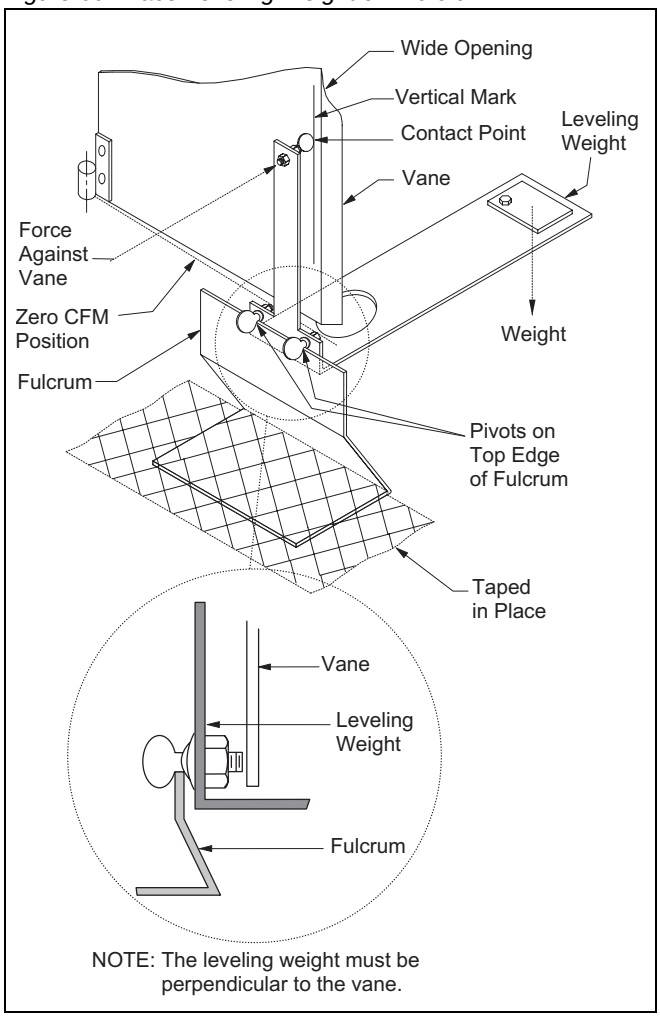
4. The leveling procedure is performed with the fans off and the outdoor air dampers closed. If there is a wind, cover the outdoor air louvers with poly film, cardboard, etc. to prevent adverse readings due to wind.

Figure 65. Tape Fulcrum Alignment Plate to Vane



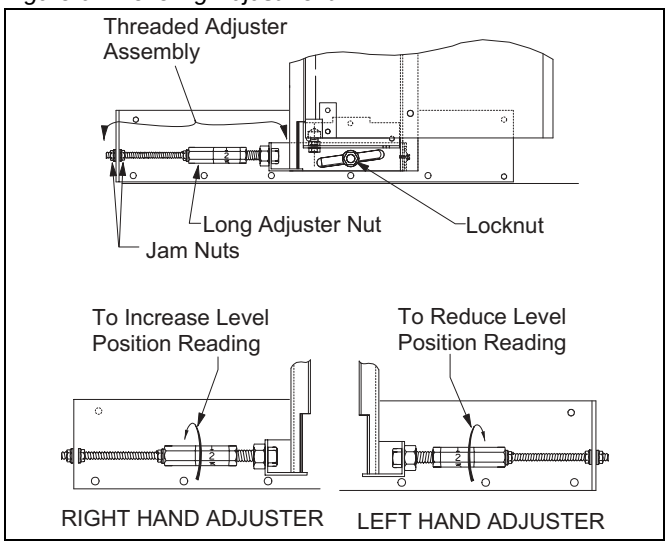
5. Tape the fulcrum Alignment Plate to the vane *(See Figure 65)*. Locate the Alignment Plate so the bottom edge of its notches are flush with the bottom edge of the vane, one side of one notch is even with the bend near the outer edge of the vane, and the plate is flat against the outer surface of the vane.
6. Install the fulcrum that is used in the leveling procedure *(See Figure 65)*. The fulcrum will be held in place with duct tape. Wipe the bottom of the louver door where the fulcrum will be located so the tape will stick. Pre-apply the duct tape to the top surface of the bottom flat of the fulcrum, having it extend about one inch beyond the edges on three sides. Once the fulcrum is positioned, these extensions can be pressed down to tape the fulcrum in place. Use the Alignment Plate to locate the fulcrum. With the Alignment Plate taped to the vane and the vane in the zero airflow position, the fulcrum is located parallel to and against the Alignment Plate. The zero airflow position is when the vane is swung away from the back wall and resting against its stop. Remove the Alignment Plate after locating the fulcrum.
7. Place the leveling weight on the fulcrum *(See Figure 66 on page 68)*. The vane has a small marker hole one inch up from the bottom and 1/2 inch in from the bend near the outer edge. There is a vertical mark intersecting the hole. The leveling weight should contact the vane along this vertical mark.

Figure 66. Place Leveling Weight on Fulcrum



8. Set up the leveling test. While holding the weight so it stays on the fulcrum, manually rotate the vane to the wide-open position, manually return it to the zero CFM position, and gently release the vane. Locate the Leveling Weight so its contact point is against the vertical mark on the vane. While the weight teeters on the fulcrum, gently rap the base frame to slightly vibrate the assembly and encourage the vane to seek its equilibrium point.
9. Read the current vane leveling position through the unit keypad/display. This is done by viewing the *LH Lvl Pos* = or *RH Lvl Pos* = parameter in the DesignFlow Setup menu. The *LH Lvl Pos* = parameter indicates the current position of the vane for the left-hand DesignFlow station. The *RH Lvl Pos* = parameter indicates the current position of the vane for the right-hand DesignFlow station. These parameters will vary from 20% to 80% depending on the position of the DesignFlow vane. For detailed information regarding operation and navigation through the unit keypad menu structure, *refer to operation manual OM137 (discharge air control units) or OM138 (zone control units).*

Figure 67. Leveling Adjustment



10. If the value indicated by the *LH Lvl Pos = (or RH Lvl Pos =)* parameter is not within the range of 23.64 to 24.08%, a leveling adjustment is required *(See Figure 67).* Leveling adjustments are accomplished by shifting the bottom of the measuring station to the right or left. If the *LH Lvl Pos = (or RH Lvl Pos =)* parameter indication is higher than specified, the bottom of the DesignFlow frame must be moved closer to the outdoor air damper. If the *LH Lvl Pos = (or RH Lvl Pos =)* parameter indication is lower than specified, the bottom of the DesignFlow frame must be moved farther from the outdoor air damper.

    To make an adjustment, loosen the .25-20 NC lock nut at the slotted hole at the bottom of the frame. The threaded adjuster facilitates small accurate movements. Reposition the two.25-20 NC jam nuts on the threaded rod to make large adjustments, then use the long adjuster nut to make fine adjustments. Rotate the long adjuster nut to move the bottom of the station. Unscrewing the long adjuster nut from the large bolt makes the assembly longer and reduces the *LH Lvl Po = (or RH Lvl Pos =)* parameter indication. Screwing in the long adjuster nut from the large bolt makes the assembly shorter and increases the *LH Lvl Pos = (or RH Lvl Pos =)* parameter indication.

    After an adjustment is made, retighten the lock nut, gently rap the base frame to slightly vibrate the assembly and encourage the vane to seek its equilibrium point. Confirm that the contact point on the fulcrum is on the vertical mark on the damper. If the contact point is not on the vertical mark, reposition the fulcrum contact point to line up with vertical mark *(Figure 66)* and take another reading.

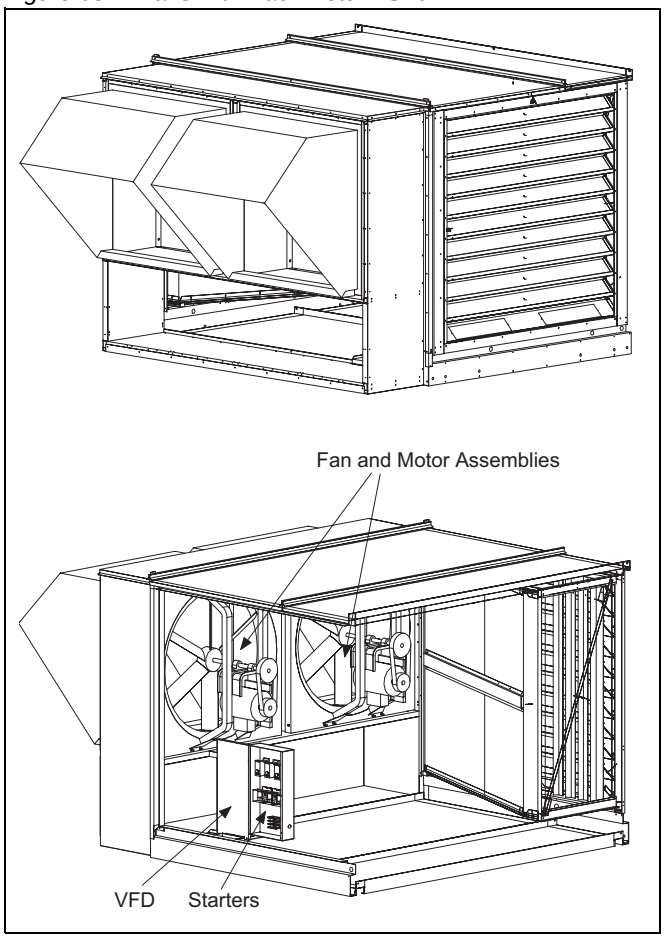
    Important: After an adjustment is made, wait until the *LH Lvl Pos = (or RH Lvl Pos =)* value on the keypad/display stabilizes before making further adjustments. This can take several seconds.

11. After leveling, remove fulcrum and replace the access opening covers.

Propeller Exhaust Fan Option

Economizer units may include propeller exhaust or centrifugal return fan options. This section covers maintenance and operating instructions for the propeller exhaust option. Centrifugal return fan construction, maintenance and operation is similar to that for supply fans and covered in other sections of this manual.

Figure 68. 2 Fans with Back Return Shown



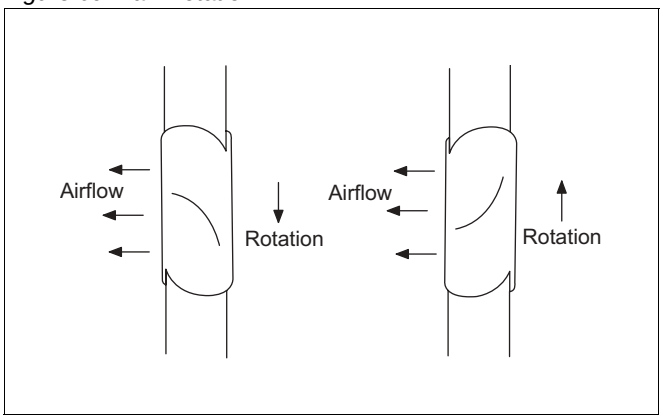
Prestarting Checks

Check all fasteners and set screws for tightness. This is especially important for bearing set screws.

The propeller should rotate freely and not rub on the fan panel venturi. Check the rotation direction of the propeller by momentarily turning the unit on. Rotation should be in the same direction as the rotation decal on the unit or as shown in *Figure 69 on page 70*. For 3-phase installations, fan rotation can be reversed by simply interchanging any two of the three electrical leads. For single phase installations follow the wiring diagram located on the motor.

The adjustable motor pulley is preset at the factory for the specified fan RPM. Fan speed can be increased by closing or decreased by opening the adjustable pulley. Two or three groove variable pitch pulleys must be adjusted an equal number of turns open. Any increase in fan speed represents a substantial increase in horsepower required from the motor. Always check motor load amperage and compare to name plate rating when changing fan speed.

Figure 69. Fan Rotation



Once the fan has been put into operation, set up a periodic maintenance program to preserve the reliability and performance of the fan. Items to be included in this program are:

- Belts
- Bearings
- Fasteners
- Setscrews
- Lubrication
- Removal of Dust/Dirt

Belts

⚠ WARNING

Rotting fan and motor belts can cause severe personal injury or death.

Secure all loose clothing, hair, jewelry and tools to avoid entrapment.

Premature belt failures are generally caused by improper belt tension (either too tight or too loose) or misaligned pulleys. The proper tension for operating a V-belt is the lowest tension at which the belts will not slip peak load conditions. For initial tensioning, the proper belt deflection half way between pulley centers is 1/64" for each inch of belt span. For example, if the belt span is 64 inches, the belt deflection should be one inch using moderate thumb pressure at midpoint of the drive, *See Figure 70 on page 70*.

Check belt tension two times during the first 24 hours of operation and periodically thereafter. To adjust belt tension, simply loosen four fasteners (two on each side of the motor plate) and slide the motor plate away from the fan shaft until proper belt tension is attained. On some fans, fasteners attaching the motor to the motor plate must be loosened in order to adjust the belt.

It is very important that the drive pulleys remain in proper alignment after adjustments are made. Misalignment of pulleys will result in premature belt wear noise, vibration and power loss, *See Figure 71 on page 70*.

Figure 70. Belt Adjustment

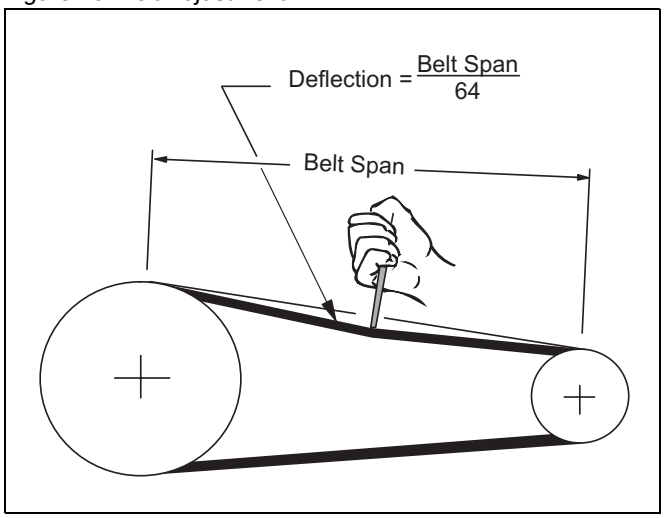
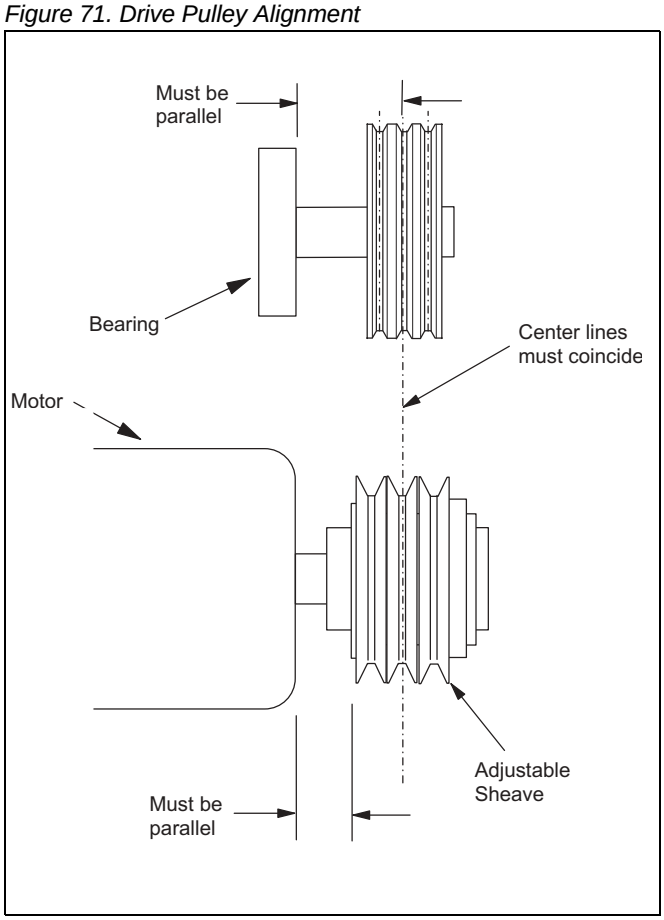


Figure 71. Drive Pulley Alignment



Bearings

Bearings are the most critical moving part of the fan and should be inspected at periodic intervals. Locking collars and set screws, in addition to fasteners attaching the bearings to the bearing plate, must be checked for tightness. In a clean environment and temperatures above 32°F/below 200°F, lubricate fan shaft bearings with grease fittings semi-annually using a high quality lithium based grease. If unusual environmental conditions exist, temperatures fall below 32°F/ or above 200°F, or if there is excessive moisture or contaminants, then lubricate more often.

With the unit running, add grease very slowly with a manual grease gun until a slight bead of grease forms at the seal. Be careful not to unseat the seal by over lubricating or using excessive pressure. Bearings without grease fittings are lubricated for life.

Fasteners and Setscrews

Any fan vibration has a tendency to loosen mechanical fasteners. A periodic inspection should include checking all fasteners and set screws for tightness. **It is important to tighten setscrews attaching the propeller to the shaft and the shaft to the bearings. Loose bearing set screws will lead to premature failure of the fan shaft.**

Lubrication

Refer to "Bearings" for bearing lubrication. Many fractional horsepower motors installed on the smaller fans are lubricated for life and require no further attention. Oil motors equipped with oil holes in accordance with the manufacturer's instructions. Use a high grade SAE 20 machine oil and use caution not to over lubricate.

Grease motors supplied with grease fittings according to directions printed on the motor.

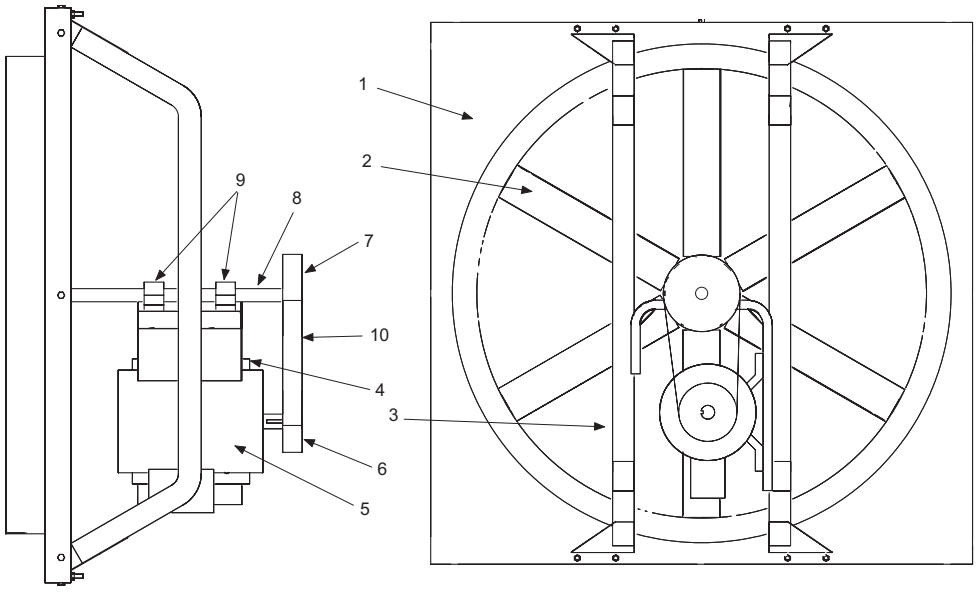
Removal of Dust/Dirt

Dirt clogs cooling openings on the motor housing, contaminates bearing lubricant and collects on propeller blades causing severe imbalance if left unchecked. Thoroughly clean the exterior surface of the motor, fan panel and entire propeller periodically. Use caution and do not allow water or solvents to enter the motor or bearings. **DO NOT** spray motors or bearings with steam or water.

Table 14: Propeller Exhaust Fan Troubleshooting

Problem	Cause	Corrective Action
Reduced Airflow	System resistance is too high.	Check backdraft dampers for proper operation. Remove obstructions in ductwork. Clean dirty filters. Check for adequate supply for air exhaust fans or exhaust air for supply fans.
	Unit running backwards.	See *"Prestarting Checks" on page 69*
	Fan speed too low.	Increase fan speed
	Excessive dirt on propeller.	Clean propeller
Excessive Noise	Bearings	Tighten bearing collars and setscrews. Lubricate bearings. Replace defective bearings.
	V-Belt drive	Tighten pulleys on motor shaft and fan shaft. Adjust belt tension. Align pulleys. Replace worn belts or pulleys.
	Excessive vibration	Clean dirt build-up from propeller. Check all setscrews and fasteners for tightness. Check for worn bearing. Correct propeller imbalance. Check for loose dampers, guards or ductwork.
	Defective motor	Replace motor.

Figure 72. Propeller Exhaust Replacement Parts List



Propeller Exhaust Fan Control

Exhaust Fan On/Off Control

The Exhaust fans are turned on and off based on building static pressure, outdoor air damper position, and discharge fan capacity. Exhaust fans do not have to always run while the supply fan is on, as the does a return fan. They are turned on and off through DO # 2 on the Mod DCU as described below.

The Exhaust Fans are turned on when:

- All of the following are true for longer than the Min Start Time (Default Time = 120 Seconds). :
  - OA Damper Capacity exceeds Min OA Dmpr Pos
  - Either the Discharge Fan Capacity exceeds the Min DF Cap or the Discharge Fan Control Type is Constant Volume. This two part condition may be able to be reduced to one condition if there is one attribute that is set to 100% when constant volume units are on and to the current fan speed or actuator position for variable air volume units.
  - The type of control (RF/EF Ctrl) is set to Building Pressure
  - The building static pressure is above the building static pressure setpoint by more than the deadband/2.

OR

- All of the following are true for longer than the Min Start Time (Default Time = 120 Seconds).
  - OA Damper Capacity exceeds Min OA Dmpr Pos
  - The Discharge Fan Capacity exceeds the Min DF Cap or the Discharge Fan Control Type is Constant Volume. This two part condition may be able to be reduced to one condition if there is one attribute that is set to 100% when constant volume units are on and to the current fan speed or actuator position for variable air volume units.
  - The type of control (RF/EF Ctrl) is set to Position
  - The Exhaust Fan VFD capacity (Rem RF/EF Cap) is set to a value above the Min Exh Fan Cap (Default = 25%) .

The Exhaust Fans are turned off when:

- All of the following are true:
  - The type of control (RF/EF Ctrl) is set to Building Pressure
  - The building static pressure is below the building static pressure setpoint by more than the deadband/2
  - The Exhaust Fan capacity is at the Min Exh Fan Cap (Default = 25%) or lower for longer than the Min Stop Time (Default Time = 120 Seconds).

OR

- Both of the following are true:
  - The type of control (RF/EF Ctrl) is set to Position
  - The Remote Exhaust Fan capacity setpoint (Rem RF/EF Cap) is set below the Min Exh Fan Cap (Default = 25%) for longer than the Min Stop Time (Default Time = 120 Seconds).

OR

- The unit is off

Exhaust Fan Speed Control

The exhaust fan variable frequency drive can be controlled by two different methods that maintain building static pressure. Fan tracking is not provided with exhaust fans. The Exhaust Fan VFD speed is increased through BO # 16 and decreased through BO # 15 on the Mod-DCU just like the Return Fan.

The minimum speed of the Exhaust Fan will be set to it's Min Exh Fan Cap (Default = 25%) through the keypad on the VFD. This same minimum speed value is to be entered through the MicroTech II keypad to provide the capability to turn on and off the Exhaust Fans as described above.

When Building Static pressure is selected, the exhaust variable frequency drive is controlled to maintain building static pressure directly. A minimum speed is maintained by the VFD, not by MicroTech II.

The outputs, BO # 15 and BO # 16, will be controlled by a Proportional/Integral (PI) algorithm that increases the speed of the VFD in order to lower the building static pressure and decreases the speed of the VFD in order to raise the building static pressure. The building static pressure will be provided as it is now through AI # 14 with a range of - .25 IWC to + .25 IWC. This control algorithm is identical to that currently used to control building static pressure using a return fan VFD except that the minimum speed (Default = 25%) is not maintained by MicroTech II.

When position control is selected, the speed of the exhaust fan variable frequency drive is controlled to the Remote RF/EF setting. BO # 15 and BO # 16 are controlled to maintain a fixed speed provided through a connected network or the keypad. This control algorithm similar to that currently used to control a return fan VFD to maintain a fixed speed except that the minimum speed (Default = 25%) is not maintained by MicroTech II. This minimum speed is maintained by the VFD.

When the unit is in an off state, the variable frequency drive is turned off by turning off BO #2. At the same time, BO #15 is turned on, and BO #16 is turned off.

Keypad Entries

Add a new table menu, Exhaust Fan Setup, after Bldg Static P Setup and before Zone Temp Setup with the following entries.

Exhaust Fan Setup

Min Exh Fan Cap = 25%(1 - 99%)

Min OA Dmpr Pos = 5%(1 - 99%)

Min DF Cap = 10% (1 - 99%)

Min Start Time = 120 s(10 - 240 sec)

Min Stop Time = 120 s(10 - 240 sec)
Check, Test, and Start Procedures

⚠ DANGER

Electric shock and moving machinery hazard. Can cause severe equipment damage, personal injury, or death.

Lock out and tag out electrical power before servicing this equipment.

All start-up and service work must be performed trained, experienced technicians.

Read and follow this manual: "MicroTech II Applied Rooftop Unit Controller" manual (Bulletin IM 696), and operation manual (Bulletin OM 137 or OM 138) before operating or servicing.

Equipment frame must be bonded to building electrical ground through grounding terminal or other approved means.

All units are completely run tested at the factory to promote proper operation in the field. Nevertheless, the following check, test, and start procedures must be performed to properly start the unit. To obtain full warranty coverage, the check, test, and start form supplied with the unit must be completed, signed, and returned to McQuay International.

A representative of the owner or the operator of the equipment should be present during start-up to receive instructions in the operation, care, and maintenance of the unit.

Before Start-up

1. Verify that the unit is completely and properly installed with ductwork connected. Verify that all construction debris is removed, and that the filters are clean.
2. Verify that all electrical work is complete and properly terminated. Verify that all electrical connections in the unit control panel and compressor terminal box are tight, and that the proper voltage is connected. Verify all nameplate electrical data is compatible with the power supply. Verify the phase voltage imbalance is no greater than 10 %.
3. Verify that gas piping is complete and leak tight. Verify that the shutoff cock is installed ahead of the furnace, and that all air has been bled from the gas lines.
4. Manually rotate all fans and verify that they rotate freely. Verify that the belts are tight and the sheaves are aligned.
5. Verify that all setscrews and fasteners on the fan assemblies are still tight. Do this by reading and following the instructions in "Setscrews" which is in the "Maintenance" section of this manual.
6. Verify that the evaporator condensate drain is trapped, and that the drain pan is level.
7. If unit is curb mounted, verify that the curb is properly flashed to prevent water leakage.
8. Before attempting to operate the unit, review the control layout description to become familiar with the control locations.
   Review the equipment and service literature, the sequences of operation, and the wiring diagrams to become familiar with the functions and purposes of the controls and devices.
   Determine which optional controls are included with the unit.
9. Before closing (connecting) the power disconnect switch, open (disconnect) the following unit control circuit switches:
   a. Main Control Panel
      Turn system switch S1 to "off."
      Electric heat units: turn switch HS1 to "off."
   b. Compressor Compartment
      Turn compressor control circuit switches CS1, CS2 to "off."
      Turn liquid line solenoid valve switches PS1, PS2, PS3 to "off."
   c. Furnace Control Compartment
      Turn furnace switch S3 to "off."
   d. Main Control Panel Switch S7.
10. If the DAC or SCC unit does not have an optional zone temperature sensor (ZNT1) connected to it, you may need to change the keypad entry under *Setup/Service \ Unit Configuration \ Space Sensor* = from "*Yes*" to "*No*"
11. If desired, all MicroTech II internal control timers can be reduced significantly by the changing the entry under keypad menu *Setup/Service \ Unit Configuration \ Timer Settings \ Service* = from "*0 min*" to "*X min*" where X is the number of minutes you want to have the unit operate with fast timers.

Power-up

1. Close the unit disconnect switch. With the control system switch S1 in the "off" position, power should be available only to the compressor crankcase heaters.
2. Turn the Switch S1 to "on". Power should now be supplied to the control panel, and the LED's on MCB1 should follow the normal startup sequence (*refer to the "MCB LED Power-Up Sequence" of IM 696*).

Fan Start-up

1. Verify all duct isolation dampers are open. Unit mounted isolation dampers may be mounted in the supply or return sections.
2. Place the unit into the "Fan Only" mode through the keypad menu *System Summary \ System \ Ctrl Mode = Fan Only.*
3. Turn Switch S7 to "on". The controller should enter the "Startup Initial" operating state.
4. If the fans are equipped with optional spring isolators, check the fan spring mount adjustment. When the fans are running they should be level. *Refer to"Spring Isolated Fans" on page 43*.
5. Verify the rotation is correct.
6. Verify the DHL safety is opening at a pressure compatible with duct working pressure limits.

Note: The supply and return fan drives are usually selected for operation in the drive's midspeed range. The return fan drives are usually shipped with fixed pitch sheaves that will provide the selected fan speed; however, the supply fan drives are usually shipped with variable pitch sheaves that are adjusted to provide the minimum fan speed. Adjust both drives for proper airflow during air balancing. For more information, *refer to "Air Balancing" on page 75*.

Economizer Start-up

⚠ CAUTION

Adjust dampers properly. Improper adjustment may damage the dampers.

When an economizer is ordered without an actuator, the linkage requires a 3.14" linear stroke to fully open it. Do not allow dampers to be driven beyond their normal full closed or full open position.

1. Check whether the outdoor air is suitable for free cooling by displaying the keypad menu *Temperature \ OA Damper \ OA Ambient* = "Low" indicates low outdoor air enthalpy; "High" indicates high outdoor air enthalpy.*Refer to "Enthalpy Control" on page 60* to verify that the enthalpy changeover control is working properly. You may want to take temperature and humidity measurements.
2. Verify that the condensing unit is properly disabled to prevent compressor operation during the procedure.
3. At the keypad, set the cooling setpoint low enough so that the controller will call for cooling. The value in *Temperature \ Zone Cooling \ Occ Clg Spt* = will need to be adjusted below the temperature shown in *Temperature \ Zone Cooling \ Control Temp* =. In addition, on DAC units, the value in *Temperature \ Discharge Cooling \ DAT Clg Spt* = will need to be adjusted below the temperature shown in *Temperature \ Discharge Cooling \ Disch Air* =.
4. Place the unit into cooling mode through the keypad menu *System Summary \ System \ Ctrl Mode = Cool Only.*
5. Observe the outdoor air dampers:
   a. If the outdoor enthalpy is low, the control algorithm should start to modulate the dampers open to maintain the discharge air setpoint.
   b. If the outdoor enthalpy is high, the dampers should maintain their minimum position. Look at menu *Temperature \ OA Damper \ MinOA Pos* =. Change this entry to another value. Verify that the dampers move to the new minimum position setpoint.
6. If the unit is equipped with the electromechanical enthalpy changeover control (Honeywell H205) and the outdoor air condition is borderline, attempt to change its input to the MicroTech II controller by turning the switch adjustment to "A" or "D". Check enthalpy status in keypad menu *Temperature \ OA Damper \ OA Ambient* =. If this reading is "Low", go to step 5a. If it is "High", go to step 5b.

Note: It may not be possible to check the economizer operation in both low and high enthalpy states on the same day. If this is the case, repeat this procedure on another day when the opposite outdoor air enthalpy conditions exist.

Heating System Start-up

General

1. At the keypad, set the heating setpoints high enough so that the controller will call for heating. . The value in *Temperature \ Zone Heating \ Occ Htg Spt* = will need to be adjusted above the temperature shown in *Temperature \ Zone Heating \ Control Temp* =. In addition, on DAC units, the value in *Temperature \ Discharge Heating \ DAT Htg Spt* = will need to be adjusted above the temperature shown in *Temperature \ Discharge Heating \ Disch Air* =.
2. Place the unit into heating mode through the keypad menu *System Summary \ System \ Ctrl Mode = Heat Only.*
3. Verify that the high ambient heat lockout temperature setpoint, *Temperature \ Zone Heating \ OATHtg Lock* = is set above the current outside air temperature (shown in *System Summary \ Temperatures \ OA Temp* =).

Gas Furnace

Refer to the "Start-up and Operating Procedures" section of the Forced Draft Gas Fired Furnace Installation Manual, Bulletin No. IM 684 or 685. Perform the start-up procedures given in it.

Electric Heat

Turn the electric heat switch HS1 to "On". The electric heaters should energize. If the unit has multistage electric heat, the MicroTech II Auxiliary Control board EHB1 should energize the heaters in successive stages. The rate of staging is set in keypad menu *Setup/Service \ Heating Setup \ Stage Time* =. The default value of "*5 min*" can be adjusted from 2 to 60 minutes.

Steam Heat

The steam valve actuator should open the valve. The steam valve is open when the valve stem is up. If the unit loses power, the spring in the actuator should drive the valve wide open. Check this by opening system switch S1.

Hot Water Heat

The hot water valve actuator should open the valve to the coil. The three-way hot water valve is open to the coil when the valve stem is down. If the unit loses power, the spring in the actuator should drive the valve wide open to the coil. Check this by opening system switch S1.

Cooling System Start-up

1. Place the unit into the *System Summary \ System \ Ctrl Mode = Cool Only* mode through keypad menu 11 {"Control Mode").
2. At the keypad, set the cooling setpoint low enough so that the controller will call for cooling. The value in *Tempera-*

ture \ Zone Cooling \ Occ Clg Spt = will need to be adjusted below the temperature shown in *Temperature \ Zone Cooling \ Control Temp* =. In addition, on DAC units, the value in *Temperature \ Discharge Cooling \ DAT Clg Spt* = will need to be adjusted below the temperature shown in *Temperature \ Discharge Cooling \ Disch Air* =.

3. The chilled water value (VMS) will modulate to maintain set point as follows: See also *"Typical Actuator Circuit" on page 56*.
   - MCB B08 closes to increase chilled water flow and increase cooling capacity.
   - MCB B07 closes to close off chilled water flow and decrease cooling capacity.

Adjusting MicroTech II Controls and Servicing Control Panel Components

Adjusting MicroTech II Controls

In order to read values, adjust setpoints, clear faults, etc., on the MicroTech II unit controller, the main unit control panel must be energized. If the unit has a factory mounted disconnect switch, the switch's bypass mechanism must be used in order to open the main control panel door without de-energizing the control panel. The bypass mechanism is activated by turning the screw at the bottom of the disconnect switch clockwise while pulling the door open. Use of the disconnect switch bypass mechanism must be done only by a qualified service technician.

⚠ WARNING

Electrical shock hazard.
May cause severe injury or death.

All protective deadfront panels must be closed when making adjustments to the MicroTech II unit controller.

Whenever the main control panel is accessed with the control panel still energized, the inner deadfront protective panels must remain closed to avoid exposure to high voltage power.

Servicing Control Panel Components

⚠ DANGER

Electrical shock hazard.
May cause severe injury or death.

Disconnect electric power before servicing equipment. More than one disconnect may be required to de-energize the unit.

All electric power to the unit must be disconnected whenever servicing control panel components located behind the protective deadfront panels. The components behind the protective deadfront panels are energized with high voltage unless electric power is disconnected to the unit. Units must always be inspected for multiple disconnects to verify all power is removed from the control panel and its components before servicing.

Air Balancing

Air balancing should be performed by a qualified air balancing technician. Note that the supply fan motors are usually shipped with variable pitch sheaves which are typically set at the low end of the drive's fan rpm range. *See "Mounting and Adjusting Motor Sheaves" on page 77*. The return fan motors are usually shipped with fixed pitch sheaves.

⚠ WARNING

Moving machinery hazard. Can cause severe personal injury or death.

Use a strobe tachometer to measure the speed of return fans. Do not use a mechanically driven tachometer on this fan arrangement.

Perform the following as part of the air balancing procedure:

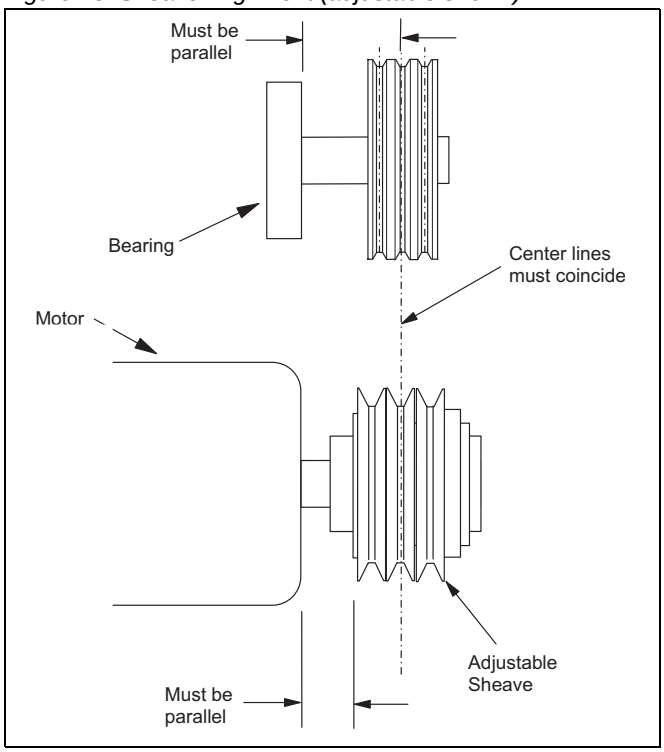
1. Check the operating balance with the economizer dampers positioned for both full outdoor air and minimum outdoor air.
2. Verify that the total airflow will never be less than that required for operation of the electric heaters or gas furnace.
3. For VAV units that are using fan tracking control, adjust the parameters for the MicroTech II controller's VaneTrol algorithm. For complete information on using this feature, see the "*Return Fan Airflow*" section in Bulletin OM 137, "*MicroTech II Applied Rooftop Unit Controller: DAC Control*".
4. When the final drive adjustments or changes are complete, check the current draw of the supply and return fan motors. The amperage must not exceed the service factor stamped on the motor nameplate.
5. Upon completion of the air balance, replace variable pitch motor sheaves (if any) with comparably sized fixed pitch sheaves. A fixed pitch sheave will reduce vibration and provide longer belt and bearing life.

Sheave Alignment

Mounting:

1. Verify both driving and driven sheaves are in alignment and the shafts are parallel. The center line of the driving sheave must be in line with the center line of the driven sheave. *See Figure 73 on page 76*.
2. Verify that all setscrews are torqued to the values shown in *Table 19 on page 86* before starting drive. Check setscrew torque and belt tension after 24 hours of service.

Figure 73. Sheave Alignment (adjustable shown)



Drive Belt Adjustment

General Rules of Tensioning

1. The ideal tension is the lowest tension at which the belt will not slip under peak load conditions.
2. Check tension frequently during the first 24-48 hours of operation.
3. Over tensioning shortens belt and bearing life.
4. Keep belts free from foreign material which may cause slippage.
5. Make V-drive inspection on a periodic basis. Adjust tension if the belt is slipping. Do not apply belt dressing. This may damage the belt and cause early failure.

Tension Measurement Procedure

1. Measure the belt span. *See Figure 74.*
2. Place belt tension checker squarely on one belt at the center of the belt span. Apply force to the checker, perpendicular to the belt span, until the belt deflection equals belt span distance divided by 64. Determine force applied while in this position.
3. Compare this force to the values in *Table 15 on page 76.*

Figure 74. Drive Belt Adjustment

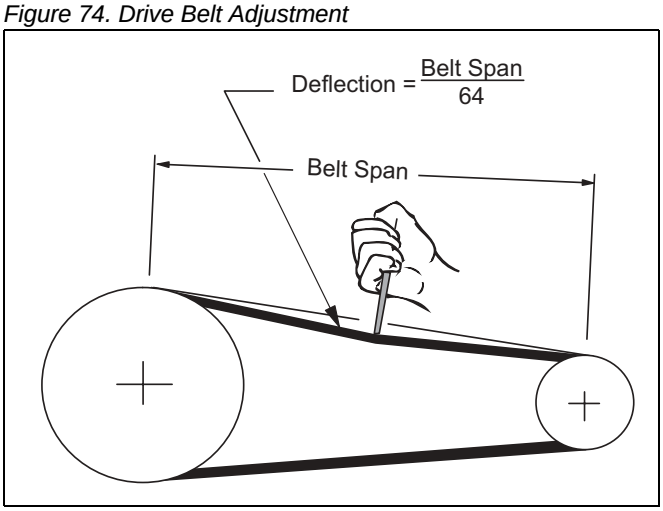
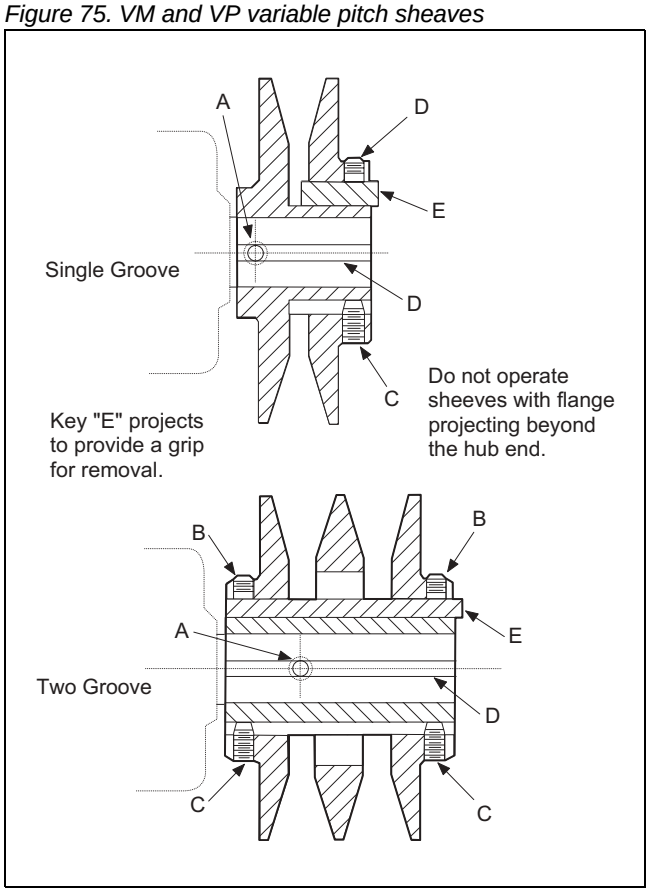


Table 15: Belt Deflection Force (not applicable for Exhaust Fans - see "Belts" on page 70)

CROSS SECTION	SHEAVE DIAMETER (INCHES)		DEFELCTION FORCE (LBS.)			
			BELT DEFLECTION FORCE			
	SMALLEST SHEAVE DIAMETER RANGE	RPM RANGE	CROSS SECTION A, B, 5V		CROSS SECTION AX, BX, 5VX	
			USED BELT	NEW BELT	USED BELT	NEW BELT
A, AX	3.0-3.6	1000-2500	3.7	5.5	4.1	6.1
		2501-4000	2.8	4.2	3.4	5.0
	3.8-4.8	1000-2500	4.5	6.8	5.0	7.4
		2501-4000	3.8	5.7	4.3	6.4
	5.0-7.0	1000-2500	5.4	8.0	5.7	9.4
		2501-4000	4.7	7.0	5.1	7.6
B, BX	3.4-4.2	850-2500	—	—	4.9	7.2
		2501-4000	—	—	4.2	6.2
	4.4-5.6	860-2500	5.3	7.9	7.1	10.5
		2501-4000	4.5	6.7	7.1	9.1
	5.8-8.6	860-2500	6.3	9.4	8.5	12.6
		2501-4000	6.0	8.9	7.3	10.9
5V, 5VX	4.4-6.7	500-1749	—	—	10.2	15.2
		1750-3000	—	—	8.8	13.2
		3001-4000	—	—	5.6	8.5
	7.1-10.9	500-1740	12.7	18.9	14.8	22.1
		1741-3000	11.2	16.7	13.7	20.1
	11.8-16.0	500-1740	15.5	23.4	17.1	25.5
		1741-3000	14.6	21.8	16.8	25.0

Mounting and Adjusting Motor Sheaves

Figure 75. VM and VP variable pitch sheaves



VM and VP Variable Pitch Sheaves

Mounting:

1. Mount all sheaves on the motor shaft with setscrew "A" toward the motor *(see Figure 75).*
2. Both the driving and driven sheaves must be in alignment and the shafts must be parallel.
3. Fit internal key "D" between sheave and shaft, and lock setscrew "A" securely in place.

Adjusting:

1. Slack off all belt tension by moving the motor toward the driven shaft until the belts are free from the grooves. For easiest adjustment, remove the belts.
2. Loosen setscrews "B" and "C" in the moving parts of the sheave and pull out external key "E" *(see Figure 75)*. This key projects a small amount to provide a grip for removing.
3. Adjust the sheave pitch diameter for the desired fan speed by opening the moving parts by half or full turns from closed position. **Do not open more than five full turns for "A" belts or six full turns for "B" belts.**
   Adjust both halves of two-groove sheaves by the same number of turns from closed to verify that both grooves have the same pitch diameter.
4. Replace external key "E" and securely tighten setscrews "B" over the key. Tighten setscrews "C" into the keyway in the fixed half of the sheave.
5. Put on belts and adjust the belt tension. **Do not force belts over grooves.** Loosen the belts by adjusting the motor base closer to the fan shaft.
6. All keys must be in place and all setscrews must be tight before starting the drive. Check the setscrews and belt tension after 24 hours of service.

LVP Variable Pitch Sheaves

Mounting:

1. For single-groove sheaves, slide the sheave onto the motor shaft so that the side of the sheave with setscrew "A" is next to the motor *(see Figure 76 on page 78)*.
   For two-groove sheaves, slide the sheave onto the motor shaft so that the side of the sheave with setscrew "A" is away from the motor *(see Figure 76 on page 78)*.
2. To remove the flange and locking rings:
   a. Loosen setscrews "D".
   b. Loosen **but do not remove** capscrews "E".
   c. Remove key "F". This key projects a small amount to provide a grip for removing.
   d. Rotate the flange counterclockwise until it disengages the threads on the shaft barrel.
3. Be sure that the driving and driven sheaves are in alignment and the shafts are parallel. When aligning two-groove sheaves, allow room between the sheave and motor to get to capscrews "E".
4. Insert key "C" between the sheave and the shaft and tighten setscrew "A" securely.

Adjusting:

1. Slack off all belt tension by moving the motor toward the driven shaft until the belts are free from the grooves. For easiest adjustment, remove the belts.
2. Loosen setscrews "D".
3. Loosen **but do not remove** capscrews "E".
4. Remove key "F". This key projects a small amount to provide a grip for removing.
5. Adjust the pitch diameter by opening or closing the movable flange by half or full turns. Note that two-groove sheaves are supplied with both grooves set at the same pitch diameter. **Both movable flanges must be moved the same number of turns to verify the same pitch diameter for satisfactory operation. Do not open sheaves more than five turns for "A" belts or six turns for "B" belts.**
6. Replace key "F".
7. Tighten setscrews "D" and capscrews "E".
8. Put on the belts and adjust the belt tension. Do not force belts over grooves. Loosen the belts by adjusting the motor base closer to the fan shaft.
9. Be sure that all keys are in place and that all setscrews and all capscrews are tight before starting the drive. Check and retighten all screws and retension the belts after approximately 24 hours of operation.

MVP Variable Pitch Sheaves

Adjusting:

1. Slack off belt tension by moving the motor toward the driven shaft until the belts are free from the grooves. For easiest adjustment, remove the belts.
2. Loosen both locking screws "A" in outer locking ring, **but do not remove** them from the sheave. There is a gap of approximately .2" (1 mm) between the inner and outer locking rings. This gap must be maintained for satisfactory locking of the sheave.
   If locking screws "A" are removed by accident and the gap is lost, screw the outer locking ring down until it touches the inner locking ring. Then back off the outer ring 1/2 to 3/4 turn until the inner and outer ring screw holes are lined up. Reinsert locking screws "A", but do not tighten them until after adjustment is made.
3. Adjust the sheave to the desired pitch diameter by turning the outer locking ring with a spanner wrench. Any pitch diameter can be obtained within the sheave range. One complete turn of the outer locking ring will result in a 0.233" (6 mm) change in pitch diameter.] **Do not open "A-B" sheaves more than 43/4 turns for "A" belts or 6 turns for "B" belts. Do not open "C" sheaves more than 9-1/2 turns.**
4. Tighten both locking screws "A" in the outer locking ring.
5. Put on the belts and adjust the belt tension. **Do not force belts over grooves.** Loosen the belts by adjusting the motor base closer to the fan shaft.

Caution: Do not loosen any screws other than the two locking screws "A" in the outer locking ring. **These screws must be tightened securely before the drive is operated.**

Figure 76. LVP variable pitch sleeves

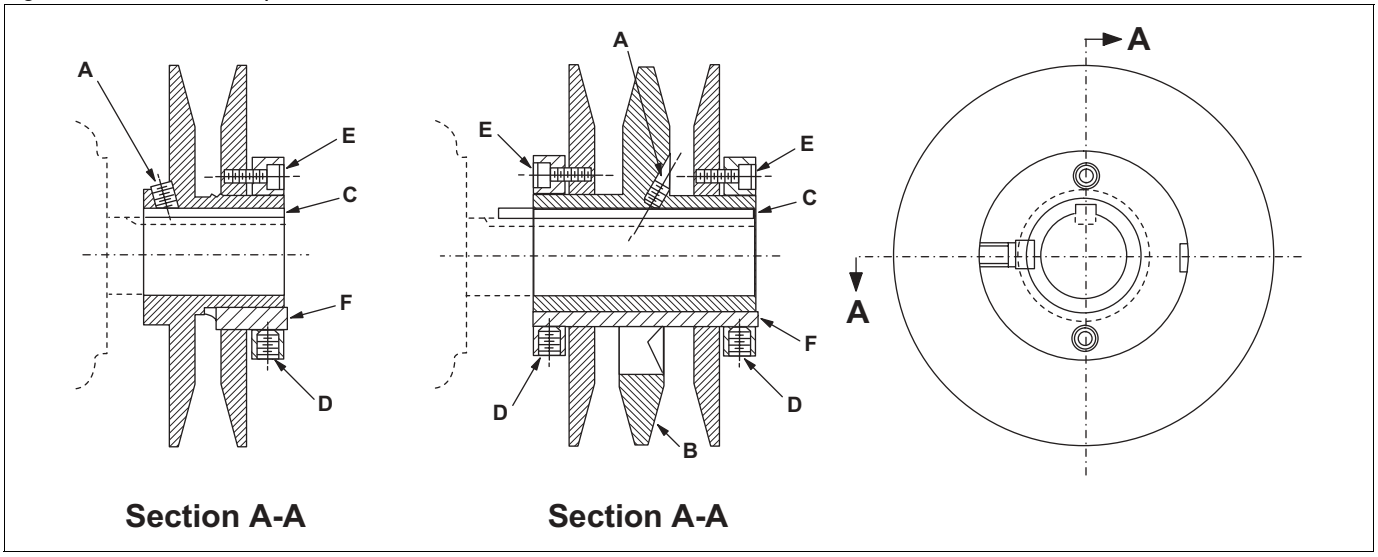


Figure 77. MVP variable pitch sheaves (type A-B)

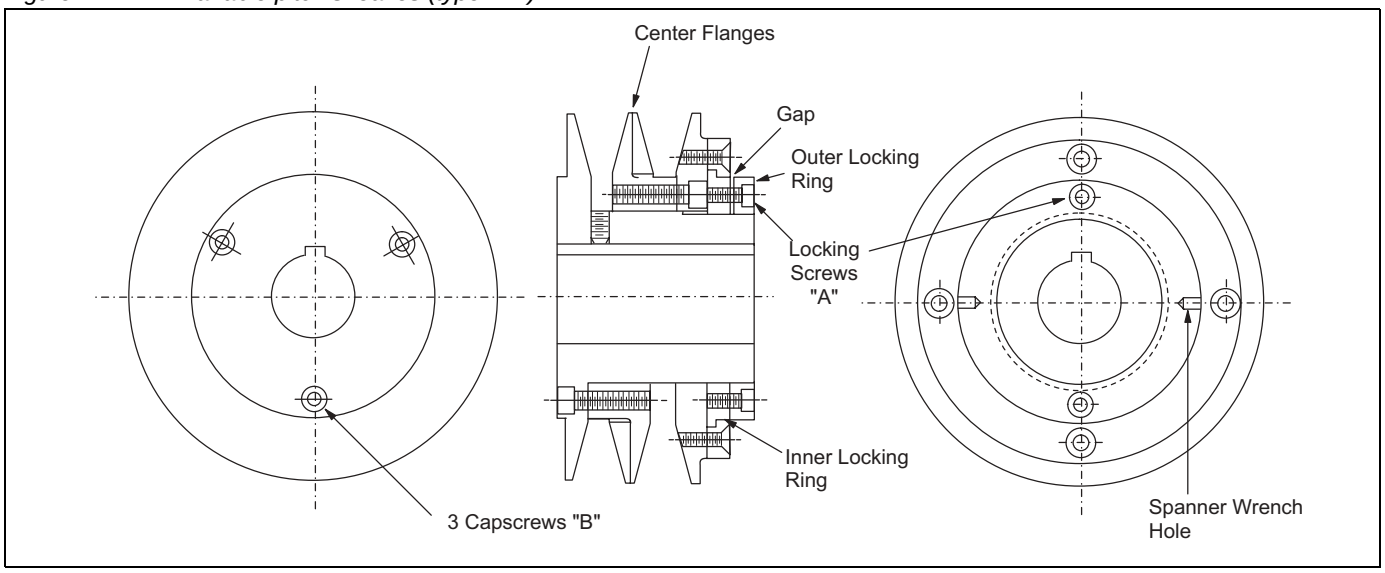
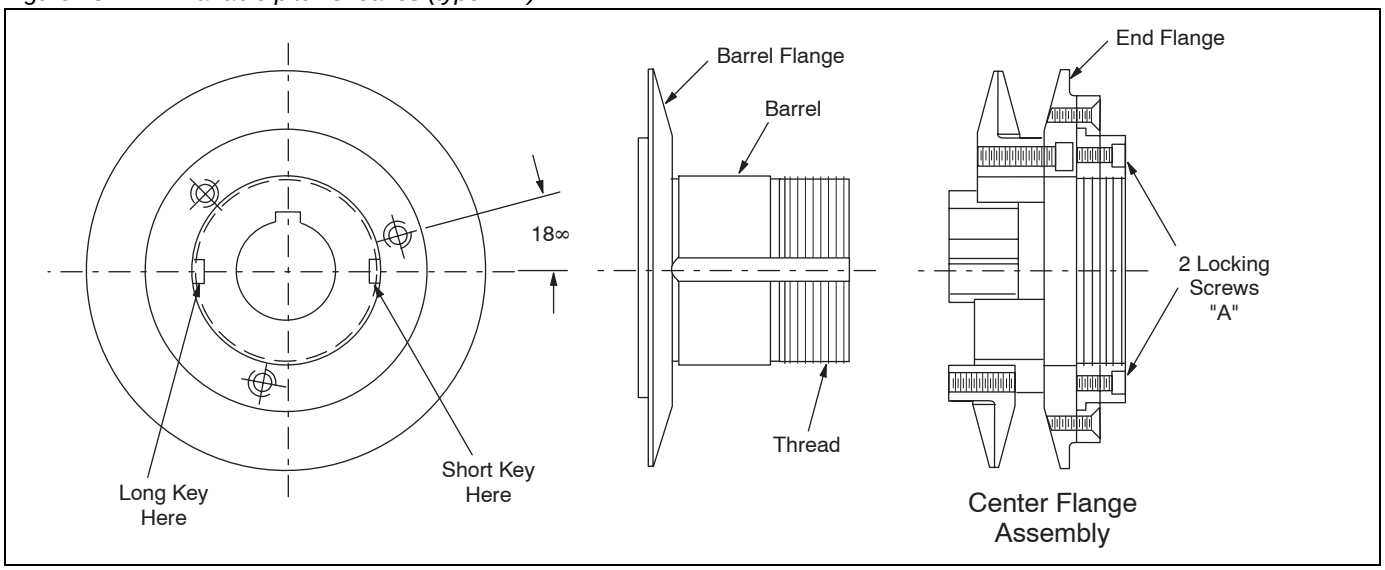


Figure 78. MVP variable pitch sheaves (type A-B)



Final Control Settings

When all start-up procedures have been completed, set the controls and program the MicroTech II controller for normal operation. Use the following list as a guide; some items may not apply to your unit. *For more detail, refer to OM696.*

1. Turn system switch S1 & S7 to "on."
2. Turn gas furnace switch S3 to "auto" or turn electric heat switch HS1 to "on."
3. Turn compressor control switches CS1 and CS2 to "on."
4. Turn liquid line solenoid switches PS1, PS2, and PS3 to "on."
5. Set the electromechanical (Honeywell H205) enthalpy control (OAE) as required (A, B, C, or D). Set the solid-state (Honeywell H705/C7400) enthalpy control (OAE/ RAE) past "D".
6. Set the heating and cooling parameters as required for normal unit operation:
   a. Temperature \ Zone Cooling \
   b. Temperature \ Zone Heating \
   c. Temperature \ Discharge Cooling \
   d. Temperature \ Discharge Heating \
7. Set the low ambient compressor lockout setpoint as required in menu , *Temperature* \ *OA Damper* \ *OATComp Lock* = . Do not set it below 50°F (10°C) unless the unit is equipped for low ambient operation.
8. Set the high ambient heat lockout temperature setpoint, *Temperature* \ *Zone Heating* \ *OATHtg Lock* = as required.
9. Set the alarm limits as required in *Setup/Service* \ *Alarm Limits* \ .
10. Set the compressor lead/lag function as desired using keypad menu *Setup/Service* \ *Compressor Setup* \ *Lead Circuit*= and *Setup/Service* \ *Compressor Setup* \ *CompCtrl*=. Refer to "*Compressor Staging*" in Bulletins OM 137 and OM 138.
    Note: If the unit has hot gas bypass on circuit #1 only, lead circuit must always be "*#1*".
11. Set the duct static pressure control parameters as required in keypad menu *Airflow* \ *Duct Pressure* \.
12. Set the building static pressure control parameters as required in keypad menu *Airflow* \ *Bldg Pressure* \.
13. Set the fan tracking parameters as required in keypad menus *Setup/Service* \ *Fan Tracking Setup* \ and *Setup/ Service* \ *Fan Balance* \.
14. Set the economizer control parameters as required in keypad menu *Temperature* \ *OA Damper* \.
15. Set the control timers as required in keypad menu *Setup/Service* \ *Timer Settings* \.
16. Set the date and time in keypad menu *Setup/Service* \ *Time/Date* \.
17. Set the operating schedule as required using keypad menus.
    Note: When used with a Building Automation System, these settings may need to be kept at the default of no schedule.:
    a. Schedules \ *Daily Schedule* \
    b. Schedules \ *Holiday Schedule* \
18. Place the unit into the Calibrate mode by using the keypad menu *Setup/Service* \ *Unit Configuration* \ *Calibrate Mode*= and changing the value from "*No*" to "*Yes*". Calibrate will automatically zero all static pressure sensors and calibrate any actuator feedback pots connected to the MicroTech II controller. When calibrate is finished, keypad menu *System Summary* \ *System* \ *UnitStatus*= will change from "*Calib*" to "*Off Man*". To restart the unit change keypad menu *System Summary* \ *System* \ *Ctrl Mode* = from "*Off*" to "*Auto*".

Maintaining Control Parameter Records

It is recommended that the MicroTech II controller's set points and parameters be recorded and saved for future reference. If the Microprocessor Control Board ever requires replacement, this record will facilitate entering the unit's proper data. The following tables display all the set points, monitoring points, and program variables offered by MicroTech II plus the keypad road map used to find each parameter. All user adjusted set points and program variables are highlighted along with their default values.

Light gray boxes in *Figure 79 on page 81*, *Figure 80 on page 82* & *Figure 81 on page 83*) indicate parameters specifically associated with discharge air temperature control.

Medium gray boxes in *Figure 79 on page 81*, *Figure 80 on page 82* & *Figure 81 on page 83*) indicate parameters specifically associated with space temperature control.

Dark gray boxes in *Figure 79 on page 81*, *Figure 80 on page 82* & *Figure 81 on page 83*) indicate parameters common to both control methods.

Keep a record of any changes made to the shaded boxes.

Figure 79. Keypad Accessible Menu Structure

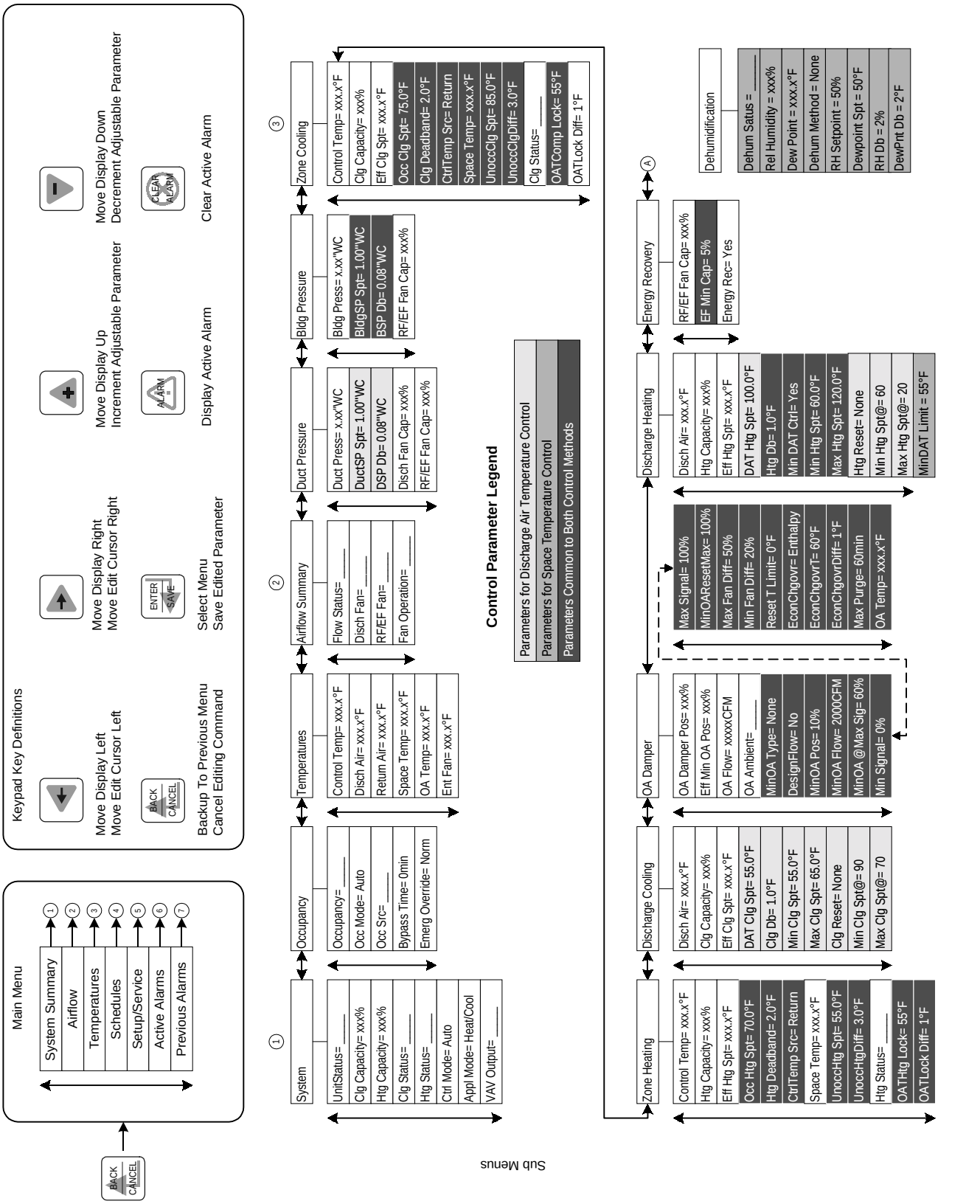


Figure 80. Keypad Accessible Menu Structure (continued)

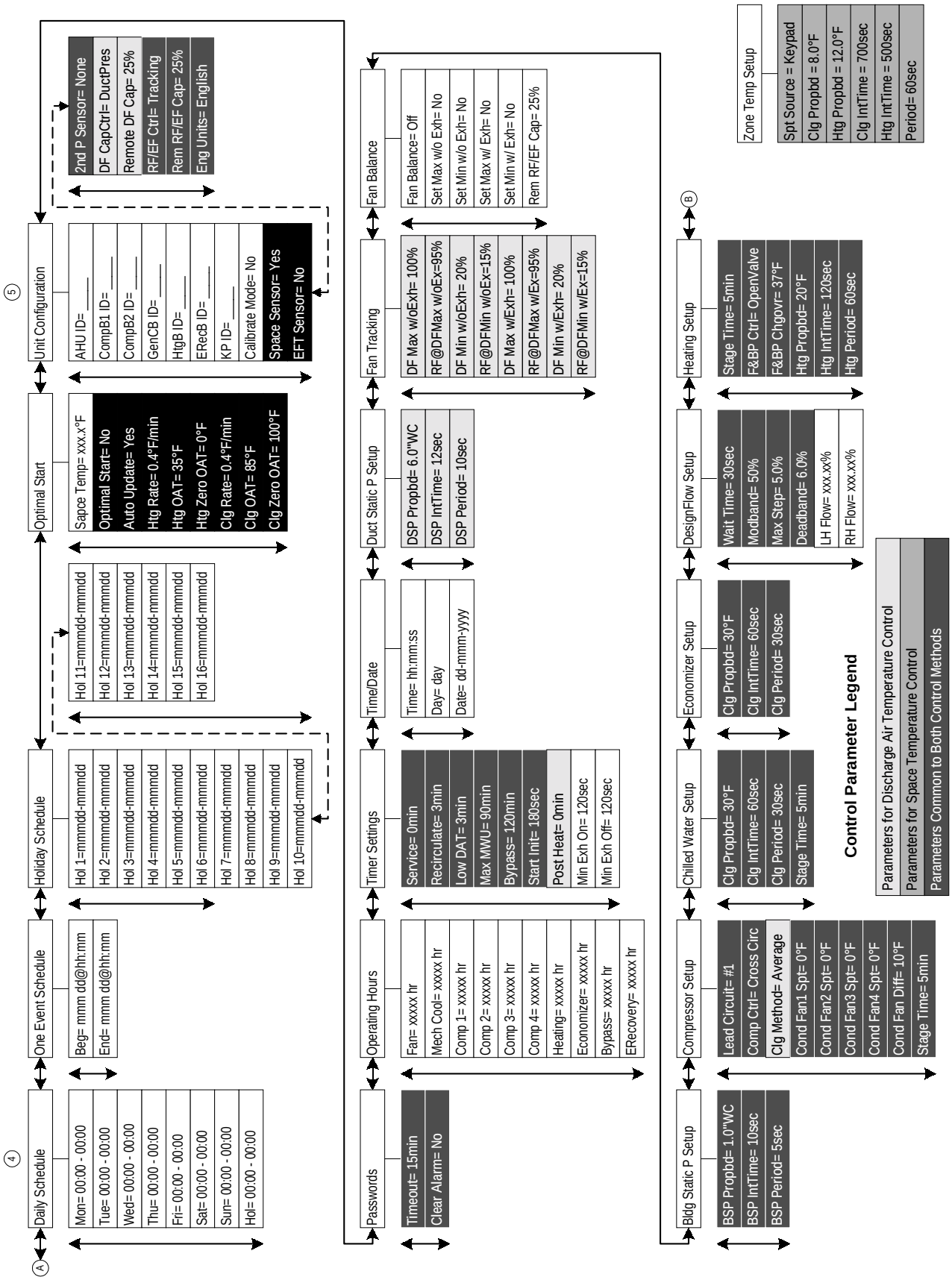
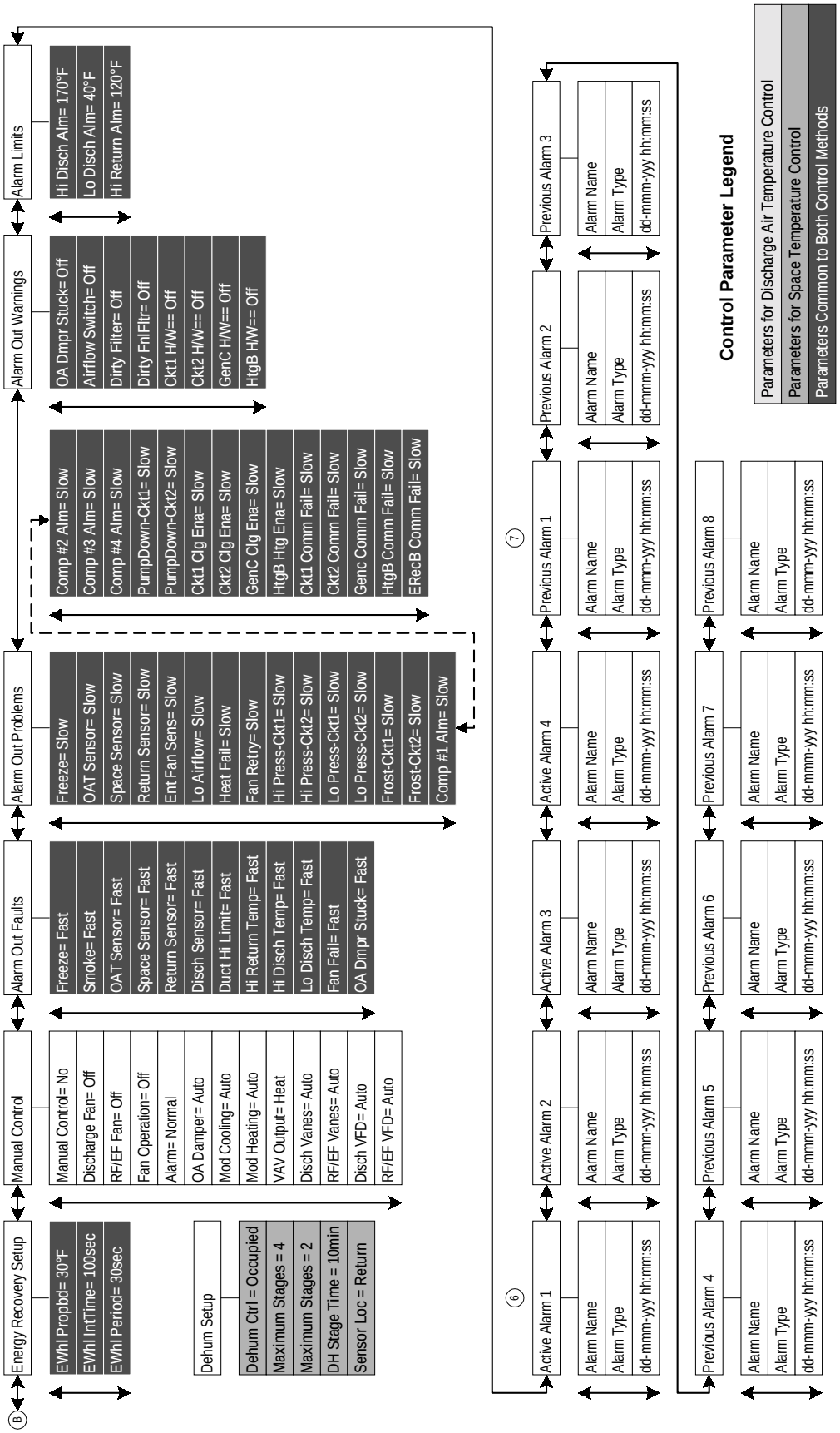


Figure 81. Keypad Accessible Menu Structure (continued)



Maintenance

Installation and maintenance must be performed only by trained personnel who are experienced with this type of equipment and familiar with local codes and regulations.

⚠ DANGER

Moving machinery and electrical power hazards. May cause severe personal injury or death.

Lock out and tag out all power before servicing equipment.

⚠ WARNING

Sharp edges are inherent to sheet metal parts, screws, clips, and similar items. May cause personal injury.

Exercise caution when servicing equipment.

Planned Maintenance

Planned maintenance is the best way to avoid unnecessary expense and inconvenience. Have this system inspected at regular intervals by a qualified service technician. The required frequency of inspections depends upon the total operating time and the indoor and outdoor environmental conditions. Routine maintenance should cover the following items:

1. Tighten all belts, wire connections, and setscrews.
2. Clean the evaporator and condenser coils mechanically or with cold water, if necessary. Usually any fouling is only matted on the entering air face of the coil and can be removed by brushing.
3. Lubricate the motor and fan shaft bearings.
4. Align or replace the belts as needed.
5. Clean or replace the filters as needed.
6. On units with remote condensing units:
   a. Check each circuit's refrigerant sightglass when the circuit is operating under steady-state, full load conditions. The sightglass should then be full and clear. If it is not, check for refrigerant leaks.
      Note: A partially full sight glass is not uncommon at part load conditions.
   b. Check for proper superheat.
   c. Refer to the condensing unit IOM for additional planned maintenance.
7. Check for blockage of the condensate drain. Clean the condensate pan as needed.
8. Check the power and control voltages.
9. Check the running amperage of all motors.
10. Check all operating temperatures and pressures.
11. Check and adjust all temperature and pressure controls as needed.
12. Check and adjust all damper linkages as needed.
13. Check the operation of all safety controls.
14. Examine the gas furnace *(see Bulletin No. IM 684 or685).*
15. Lubricate the door latch mechanisms.

Unit Storage

Location

The McQuay Rooftop Packaged System Unit is an outdoor unit. However, the schedule may dictate storage either on the ground or in its final position at the site. If the unit is stored on the ground, take these additional precautions:

1. Support the unit well along the length of the base rail.
2. Level the unit (no twists or uneven ground surface).
3. Provide proper drainage around the unit to prevent flooding of the equipment
4. Provide adequate protection from vandalism, mechanical contact, etc. The condenser fins are particularly vulnerable to damage by even light contact with ground based objects.
5. Provide unit doors are securely closed and locked.
6. If isolation dampers are provided, verify that they are properly installed and fully closed to prevent the entry of animals and debris through the supply and return air openings.
7. Fit units without isolation dampers with covers over the supply and return air openings.

Preparation

Supply (and Return) fans

1. Move the motor base to check and lubricate slides and leadscrews.
2. Remove the drive belts, tag them with the fan name and unit serial number and store them in a conditioned space out of direct sunlight.
3. Once every two weeks, rotate the fan and motor shafts. Mark the shaft positions fIrst to make sure they stop in a different position.
4. Depending on local climatic conditions, condensate ~ collect on components inside the units. To prevent surface rust and discoloration, spray all bare metal parts with a rust preventive compound. Pay close attention to fan shafts, sheaves, bearings and bearing supports,

Cabinet Sections

1. Once a month, open a door on each section and verify that no moisture or debris is accumulating in the unit.

Gas Furnace

If the unit is equipped with a gas furnace, close the gas shutoff valve and open furnace control switch S3.

Control Compartment

1. McQuay International recommends that the electronic control equipment in the unit be stored in a 5% to 95% RH (non-condensing) environment.

2. It may be necessary to put a heat source (light bulb) in the main control panel to prevent the accumulation of atmospheric condensate within the panel.
3. The location and wattage of the heat source will be dependent on local environmental conditions.
4. Check the control compartment every two weeks to provide that the heat source is functional and is adequate for current conditions.

Restart

After extended storage, a very complete start up must be performed. Inevitable accumulations of dirt, insect nests, etc. can contribute to problems if not cleaned out thoroughly prior to start up. In addition, thermal cycling will have tended to loosen mechanical and electrical connections. Following the start up procedure will help discover these and other issues that may have developed during the storage interval.

Gas Furnace

For information on maintenance of the gas furnace, *refer to Bulletin No. IM 684 or 685.*

Bearing Lubrication

⚠ CAUTION

Bearing overheating potential. Can cause damage to the equipment.

Do not overlubricate bearings. Use only a high grade mineral grease with a 200°F safe operating temperature. *Refer to Table 16 on page 85* for specific recommended lubricants.

Motor Bearings

Supply and return fans - Supply and return fan motors should have grease added after every 2,000 hours of operation. Use one of the greases shown in *Table 16*. Using the following procedure, relubricate the bearings while the motor is warm, but not running.

1. Remove and clean upper and lower grease plugs.
2. Insert a grease fitting into the upper hole and add a small amount of clean grease with a low pressure gun.
3. Run the motor for five minutes before replacing the plugs.

Note: Specific greasing instructions may be found on a tag attached to the motor. If special lubrication instructions are on the motor, they will supersede all other instructions.

Condenser fan - Condenser fan motors are permanently lubricated and require no periodic lubrication.

Fan Shaft Bearings

Relubricate fan shaft bearings periodically. Re-lubricate according to the schedule shown in *Table 17*. If the bearings are exposed to wet conditions, wide temperature variations, or other severe atmospheric conditions, relubricate more frequently. Use one of the greases shown in *Table 16*.
While the bearing is at normal operating temperatures, rotate the fan by hand and add only enough grease to purge the seals. The seals will bleed slightly when this has occurred. Do not overlubricate.

Table 16: Recommended greases

MANUFACTURER	PRODUCT NAME	TEMP. RANGE (°F)
Texaco Lubricants Co.	Premium RB	-30 to 300
Keystone Ind. Lubricants	84EP-2	-40 to 200
Mobil Oil Corporation	Mobilith AW2	-40 to 325
Chevron U.S.A. Inc.	SRI-2	-20 to 325
Exxon Company. U.S.A.	Ronex MP	-40 to 300
Shell Oil Company	Alvania No. 2	-20 to 240

Table 17: Recommended Fan Shaft Bearing Lubrication Intervals

OPERATING DUTY	BEARING AMBIENT TEMPERATURE		
	TO 130°F	TO 150°F	OVER 150°F
Continuous	6 months	4 months	2 months
12 Hrs./Day	12 months	12 months	6 months

Vibration Levels

Each unit as shipped has been trim-balanced to operate smoothly. To provide satisfactory operation after shipping and installation, use the accepted industry guidelines for field balancing fans. See *Table 18*.

Table 18: Vibration Levels

FAN SPEED (RPM)	VIBRATION
800 or less	5 mils maximum displacement
801 or greater	0.20 in/sec. maximum velocity

Note: Excessive vibration from any cause contributes to premature fan and motor bearing failure. Monitor overall vibration levels every six months of operation. An increase in levels indicates potential trouble.

Vibration Causes

1. Wheel imbalance.
   a. Dirt or debris on wheel blades.
   b. Loose setscrews in wheel hub or bearing-to-shaft.
   c. Wheel distorted from overspeed.
2. Bent shaft.
3. Drive faulty.
   a. Variable pitch sheaves - Axial and radial runout of flanges; uneven groove spacing; out of balance. Also similar faults in driven sheave.
   b. Bad V-belts; lumpy, or mismatched; belt tension too tight or too loose.
4. Bad bearings, loose bearing hold-down bolts.
5. Motor imbalance.
6. Fan section not supported evenly on foundation.

Periodic Service and Maintenance

1. Check all moving parts for wear every six months.
2. Check bearing collar, sheave, and wheel hub setscrews, sheave capscrews, and bearing hold-down bolts for tightness every six months.

Setscrews

Setscrews lock bearings, sheaves, locking collars, and fan wheels to their shafts. It is very important that all setscrews be checked periodically to provide that they have not loosened. If this is not done, severe equipment damage could occur.

Using *Table 19*, check the tightness of all setscrews with a torque wrench. Note that if the return fan bearings setscrews must be retightened, a special procedure is required to equally load both bearings *(see "Return Fan Bearing Setscrews").*

Table 19: Setscrew Minimum Torque Specifications

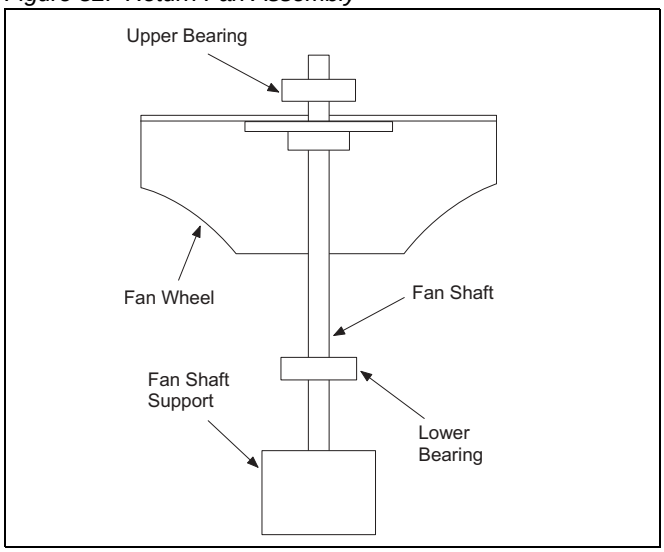
SETSCREW DIAMETER (IN.)	MINIMUM TORQUE (FT.LB)
1/4	5.5
5/16	10.5
3/8	19.0
7/16	29.0
1/2	42.0
5/8	92.0

Return Fan Bearing Setscrews

Because the return fan is mounted on a vertical shaft, the following procedure must be used to retighten any return fan bearing setscrews that have loosened. This procedure will provide that both bearings are equally loaded. If one bearing is carrying the entire weight of the fan, it could fail prematurely.

1. Loosen the fan belts.
2. Support the weight of the fan and the fan shaft with timbers or some other suitable means *(see Figure 82).*
   Important: In order to maintain proper drive alignment and fan-to-tunnel clearance, the fan and shaft must not drop at all when the setscrews are loosened in Step 4.
3. Verify that the upper shaft collar is securely fastened to the shaft. Check the setscrew torque.
4. Loosen the upper and lower bearing setscrews. The entire weight of the fan and shaft is now supported by the fan shaft support.
5. Retighten all bearings to the torque specification given in *Table 19.*
6. Remove the fan shaft support and retension the belts.

Figure 82. Return Fan Assembly



Airfoil Supply Fan Wheel-to-Funnel Alignment

If the unit is equipped with an airfoil or backward curved supply fan, the fan wheel-to-funnel alignment must be as shown in *Figure 83 Figure 84*, *Figure 85 and Figure 86 on page 87* to obtain proper air delivery and operating clearance. If necessary, adjustments are made as follows:

1. Verify that the fan shaft has not moved in its bearings.
2. Loosen the fan hub setscrews and move the wheel(s) along the shaft as necessary to obtain the correct dimension shown in *Table 20 and Table 21 on page 87*.
3. Retighten the setscrews to the torque specification given in *Table 19 on page 86*. Tighten the setscrews over the keyway first; tighten those at 90 degrees to the keyway last.
4. Verify that the radial clearance around the fan is uniform. Radial clearance can be adjusted by slightly loosening the funnel hold-down fasteners, shifting the funnel as required, and retightening the fasteners.

Figure 83. 20" Airfoil Wheel-to-Funnel (RDS 800C)

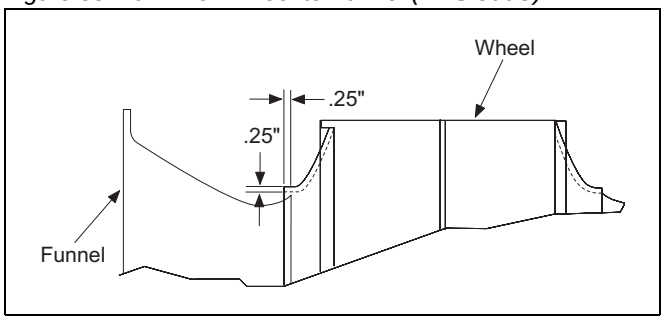


Figure 84. 24" Backward Curved Wheel-to-Funnel (802C)

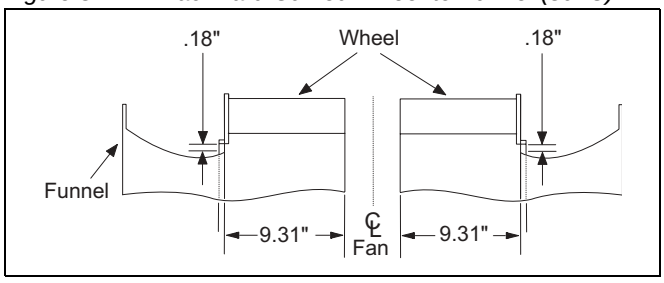


Figure 85. 27" - 40" Airfoil Wheel-to-Funnel Alignment

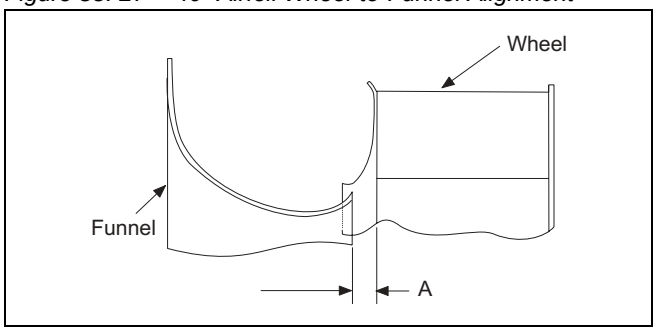


Table 20: Airfoil Wheel-to-Funnel Tolerances

Wheel-to-Funnel Relationship (In Inches)	
Wheel Diameter Inches)	"A" +0.3/ —0.0
27	.31" (8mm)
30	.31" (8mm)
33	.31" (8mm)
36	.44 (11mm)
40	.62" (16mm)

Figure 86. 44" & 49" Airfoil Wheel-to-Funnel Alignment

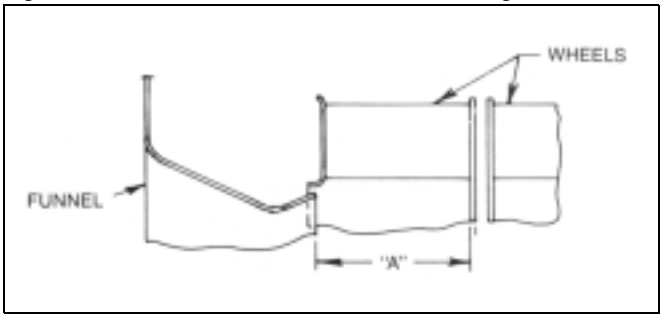


Table 21: 44" & 49 Airfoil Wheel-to-Funnel Tolerances

WHEEL-TO-FUNNEL RELATIONSHIP	
WHEEL DIA. (IN.)	**"A" (IN INCHES)**
40	16.21 (412 mm)
49	17.81 (452 mm)

Winterizing Water Coils

Coil freeze-up can be caused by such things as air stratification and failure of outdoor dampers and/or preheat coils. Routine draining of water cooling coils for winter shutdown cannot be depended upon as insurance against freeze-up. Severe coil damage may result. It is recommended that all coils be drained as thoroughly as possible and then treated in the following manner.

Fill each coil independently with an antifreeze solution using a small circulating pump and again thoroughly drain.

Check freezing point of antifreeze before proceeding to next coil. Due to a small amount of water always remaining in each coil, there will be a diluting effect. The small amount of antifreeze solution remaining in the coil must always be concentrated enough to prevent freeze-up.

Note: Carefully read instructions for mixing antifreeze solution used. Some products will have a higher freezing point in their natural state than when mixed with water.

Standard Limited Product Warranty

Consult your local McQuay Representative for warranty details. Refer to Form 933-43285Y. To find your local McQuay Representative, go to www.mcquay.com.

Service and Warranty Procedure

Replacement Parts

When writing to McQuay for service or replacement parts, provide the model number, serial number, and unit part number of the unit as stamped on the serial plate attached to the unit. For questions regarding wiring diagrams, it will be necessary to provide the number on the specific diagram. If replacement parts are required, include the date of unit installation, the date of failure, an explanation of the malfunction, and a description of the replacement parts required.

In-Warranty Return Material Procedure

Material other than compressors may not be returned except by permission of authorized factory service personnel of McQuay International at Minneapolis, Minnesota.

A "return goods" tag will be sent to be included with the returned material. Enter the information as called for on the tag in order to expedite handling at out factories and issuance of credits. All parts shall be returned to the factory designated on the return goods tag, transportation charges prepaid.

The return of the part does not constitute an order for replacement. A purchase order for the replacement part must be entered through your nearest McQuay representative. The order should include the component's part number and description and the model and serial numbers of the unit involved.

If it is determined that the failure of the returned part is due to faulty material or workmanship within the standard warranty period, credit will be issued on the customer's purchase order.

Replacement Parts List

Table 22: Microtech II Components Parts List

Component Designation	Description	McQuay Part Number
MCB	Main Control Board	060006101
CCB1	Auxiliary Cooling Control Board (DX Circuit #1 or Generic Condenser)	106102701
CCB2	Auxiliary Cooling Control Board (DX Circuit #2)	106102701
EHB1	Auxiliary Electric Heat Control Board	106102801
ERB1	Auxiliary Energy Recovery Control Board	106102701
-	Keypad/Display	060006301
-	Keypad-Main Control Board Cable	111044601
ZNT1	Zone Temperature Sensor with Tenant Override	111048101
	Zone Temperature Sensor with Tenant Override & Remote Setpoint Adjustment (SCC units only)	111048102
DAT	Discharge Air Temperature Sensor (50 ft cable length-field cut to length)	060004705
ENT	Entering Fan Air Temperature Sensor (50 ft cable length-field cut to length)	060004705
OAT	Outside Air Temperature Sensor (50 ft cable length-field cut to length)	060004705
RAT	Return Air Temperature Sensor (50 ft cable length-field cut to length)	060004705
SPS1	Static Pressure Sensor: Duct, No. 1	049545007
SPS2	Static Pressure Sensor: Duct, No. 2	049545007
	Static Pressure Sensor: Building (Space) Pressure	049545006
T2	Transformer: 115/24 VAC	060004601
T3	Transformer: 115/24 VAC	060004601
T9	Transformer: 115/24 VAC	060630801
HUM1	Humidity Sensor: Wall Mount	067294901
	Humidity Sensor: Duct Mount	067295001
PC5	Dirty Filter Switch: First Filter Section	065493801
PC6	Dirty Filter Switch: Final Filter Section	065493801
PC7	Airflow Proving Switch	060015801
DHL	Duct High Limit Switch	065493801
OAE	Enthalpy Control: Electromechanical	030706702
	Enthalpy Control: Electronic (Used with RAE)	049262201
RAE	Return Air Enthalpy Sensor (Used with Electronic OAE)	049262202
SD1	Smoke Detector: Supply Air	049025001
SD2	Smoke Detector: Return Air	049025001
-	BACnet MS/TP Communication Module (RS485)	060006202
-	BACnet/IP Communication Module (Ethernet Cable 10BASET)	060006201
-	LonMark Space Comfort Controller (SCC) Communication Module	060006203
-	LonMark Discharge Air Controller (DAC) Communication Module	060006204
-	N2 Communication Module (For Auxiliary Control Boards)	106457101
-	5 VDC Power Supply	111049601
-	Serial Port Ribbon	111047201

This document contains the most current product information as of this printing. For the most up-to-date product information, please go to **www.mcquay.com.**

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